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NOTES ON AMERICAN WILLOWS. VI.

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a. THE SPECIES OF THE SECTION *PHYLICIFOLIAE*

THE following study of the species of the section *Phylicifoliae* is chiefly based on the collections of the herbaria of the Arnold Arboretum, the Field Museum of Chicago, the Californian Academy, the Missouri Botanic Garden, the Geological Survey of Canada, the Leland Stanford University, of Professor W. L. Jepson, Berkeley, Cal., and of the Gray Herbarium and the National Herbarium, but I have been able to consult also some types from the Kew Herbarium and some specimens from the herbaria of the University of Washington and of the University of Wyoming. My thanks are due to the gentlemen in charge of these collections.

It is not without reluctance that I adopt the name *Phylicifoliae* Dumortier for the group to which I refer the following species. I have dealt with the forms of eastern Asia of this section in Sargent, Pl. Wils. III. 122 (1916). To the synonyms there given is to be added: Sect. *Argenteae* Ball in Coulter & Nelson, New Man. Rocky Mts. Bot. 136 (1909), non Koch, and sect. *Argentea* Rydberg, Fl. Rocky Mts. 189 (1917), pro parte. Even if we should place *S. pellita* and the other species with permanently hairy leaves in a different section, the name *Argenteae* used by Ball could, in my opinion, not be adopted because the American species cannot be united with those forms which have been referred by Koch (De Salic. Comm. 46. [1828]) to his section *Argenteae* for which the oldest name is sect. *Incubaceae* Dumortier (Fl. Belg. Prodr. 12 [1827]). Rydberg's *Argentea* group is a mixture of forms of very different relationship. He proposed, in 1906 (Fl. Colo. 93) a sect. *Pellitae*, and it might be the best to use this name for our group if a more thorough study of the relationship of the different sections should prove that the American forms of the *Phylicifoliae* are more closely related to each other than to the species of the Old World.

I am doubtful whether a species like *S. pulchra* Chamisso should be included in this section. It seems to me that it may have closer relations with *S. Richardsonii* Hooker and its allies. But, of course, that is a question which only can be decided if one is better acquainted with all these forms than I am at present. *S. pulchra* differs from the other species of this section by its well-developed and more or less persistent stipules.

The following key is mainly based on the characters afforded by the leaves. I have not yet been able to elaborate separate keys for male and female specimens of which the determination is a rather difficult task owing to the precociousness of the aments and the great similarity especially of the male flowers. It needs a careful comparison of a well-collected series of flowering specimens of each species to thoroughly establish the differences between them without the aid of the leaves.

CLAVIS SPECIERUM VARIETATUMQUE

Folia normalia superiora adulta glabra vel fere glabra (confer etiam 6b. *S. pellitam* var. *psilam*); ramuli hornotini annotinique plus minusve castanei vel purpureo-brunnei et nitiduli sed haud vel raro leviter pruinosi.

Stipulae fere semper valde evolutae, lineares ad lanceolatae, denticulatae, saepe persistentes, 0.5–2.5:0.1–0.6 cm. magnae; folia superiora plus minusve rhombico-oblancoolata, obovato-oblonga vel rhombico-elliptica, utrinque acuta vel apice fere subacuminata, 4:1.5 ad 6:2.5 vel surculorum ad 10:3.2 cm. magna, margine integerrima vel satis indistincte rarius subdensius glanduloso-subserata, superne intense viridia, saepissime estomatifera, subtus albo-glauescentia; petioli 5–10 mm. longi; amenta mascula circiter 2.5–3.5:1.2 cm., fructifera ad 6.5 cm. magna; fructus ovoideo-rostrati pedicello brevissimo glandula $\frac{1}{2}$ -ad 2-plo breviora excluso 7–8 mm. magni; styli 1.2–2 mm. longi. Ramuli novelli glabri vel sparse (interdum etiam annotini parce unilateraliter) pilosi 1. *S. pulchra*.

Ramuli novelli dense griseo- vel flavescenti-villoso-tomentosi.

1b. *S. pulchra* var. *yukonensis*.

Stipulae semper nullae vel etiam in ramulis vegetis quam petioli duplo breviores, deciduae et plantae aliis signis diversae.

Filamenta basi pilosula; folia superiora ramulorum breviorum vel (infima et) media ramulorum vegetorum anguste ad late obovata vel obovato-oblonga, basi plusminusve cuneata, apice subito brevissime acuta vel plicato-acuta, 4:1.8 — 6:3.3 vel ad 7.5:3 vel angustiora ad 6:2 cm. magna, initio subtus plus minusve breviter sericeo-pilosa; amenta feminea 4.5–6.5 (–8) cm. magna; fructus ellipsoidei subrostrati, ad 8 mm. longi pedicello ad 1.5 mm. longo excluso.

5. *S. pennata*.

Filamenta glaberrima; folia haud vel rarissime late obovalia et plantae aliis signis diversae.

Fructus perfecte maturi 5–6 mm. longi pedicello brevi glandulam haud vel vix $\frac{1}{2}$ -plo superante excluso; styli 0.8–1.5 mm. longi; amenta fructifera vix ultra 4:1.2 cm. magna, mascula 1–2:1–1.2 cm. magna; folia (surculorum ex parte excepta) integerrima vel (pleraque tantum partim) satis indistincte glanduloso-crenato-denticulata, lanceolata. elliptico-lanceolata, elliptica vel obovato-oblonga, utrinque acuta vel apice obtusiora, rarius ovali-lanceolata, 2:0.7 ad pleraque haud ultra 5:2–1.5 cm. magna, superne vivide viridia, (novella saepe excepta) glaberrima, estomatifera vel stomatibus plusminusve numerosis praedita, subtus valde discoloria, glauescentia, glabra vel sparse breviter pilosa (confer etiam *S. Nelsonii*, p. 80).

4. *S. planifolia* et var.

Fructus perfecte maturi 7–10 mm. longi pedicello glandulam 2- vel pluriplo superante excepto et plantae aliis signis diversae.

Folia normalia plus minusve distincte (interdum tantum partim) crenato-vel dentato-serrata, adulta subrigide chartacea, 4:1.5 ad 8:3 cm. magna, superne glaberrima vel initio ad costam puberula, demum lucide viridia, subtus glauescentia, glaberrima vel novella sparse (pilis interdum rufis)

pilosa; ramuli etiam novelli glabri vel initio parce pilosuli; amenta mascula plusminusve sessilia, 1-3.5:1.5-1.8 cm., feminea sub anthesi 1.2:0.5-0.8 cm., fructifera 4-7:1.4-1.5 cm. magna, saepe pedunculo brevi foliolis parvis 2-3 instructo suffulta; fructus e basi ovoideo conico-subrostrati, 6-8 (-10) mm. longi, stylis 0.5-2 mm. longis; pedicelli glandulam 2-3-plo superantes 2. *S. phlycifolia*.
 Folia normalia indistinctius crenato- vel undulato-dentata, subtenuiora, 5.5:1.7 ad 10:2.7 cm. magna, superne saltem initio pube tenui villosulo griseo vel rufescenti praedita, demum costa excepta glabra vel subglabra, subtus glaucescentia, initio pleraque magis quam superne villosula, demum glabrescentia; ramuli novelli (hornotinique ex parte) plusminusve villosuli; amenta mascula ignota, feminea adulta vel fructifera 2-3:0.7-1 cm. magna, pedunculo 2-4 mm. longo foliolis parvis paucis obrito suffulta; fructus e basi ovoideo conico-rostrati, ad 10 mm. longi, stylis 0.6-1.1 mm. longis; pedicelli glandulam ad 3-plo superantes, ad 2 mm. longi.

3. *S. parauleuca*.

Folia normalia superiora adulta subtus dense sericea vel sericeo-velutina, saepe micantia.

Ramuli hornotini annotinique plusminusve distincte pruinosi, etiam novelli glabri vel parcellissime pilosi et cito glabrescentes.

Pagina inferior foliorum omnium pilis strictis brevibus adpressis dense (in ramulis vegetis satis tenuiter argenteo-tomentosa, costa elevata flavescente vel fusciscente subglabriore, folia adulta chartacea, majora anguste ad late lanceolata vel oblanceolata, basi obtusa vel sensim acuta, apice acuta vel breviter acuminata, 4:0.9 ad 6:1.5 vel majora latiora ad 8-10:2-2.8 cm. magna, integerrima vel satis indistincte undulato-crenata; petioli 2-7 (-10) mm. longi; amenta mascula 2-3.5:1.1 cm. magna, feminea sub anthesi 2-2.5:0.7, fructifera 2.5-5:1 cm. magna; fructus ovoideo-subrostrati vel ovoideo-conici, circ. 5 mm. longi, pedicello glandula subduplo breviori excluso; styli 0.8-1.5 mm. longi 7. *S. subcoerulea*.

Pagina inferior (saltem foliorum superiorum et surculorum) subtus pilis sericeo-lanuginosis vix strictis longioribus vix vel haud adpressis velutino-tomentosa, folia adulta in *S. pellita* saepe plusminusve glabrescentia et plantae aliis signis diversae.

Folia lingulato-lanceolata, oblanceolata, lineari-lanceolata ad lanceolata, basi obtusa vel sensim cuneata, apice sensim acuta vel subacuminata, maxima surculorum late lanceolata, 3:0.6 ad 5:1 vel ad 9:1 vel latiora 8:1.5, maxima ad 13:3 vel 12:1 cm. magna, integerrima vel indistincte subcrenata, saepe margine subrevoluta, superne brevopilosa adulta costa excepta glabra, nervis lateralibus subimpressis, subtus novella densissime sericeo-tomentosa vel velutina, demum plus minusve glabrescentia et saepe tenuiter reticulata; petioli 2-10 mm. longi; amenta mascula ignota, feminea 2-5:1 cm. magna et in fructu paullo majora; fructus maturi ovoideo-conici, subrostrati, pedicello glandulam paullo vel ad duplo superante excluso circ. 5 mm. longi, quam ovaria subglabriores; styli 1-1.5(-2) mm. longi . . . 6. *S. pellita*.

Folia inferioribus oblongioribus exceptis pleraque lanceolata, basi plus minusve obtuse cuneata, apice acutiora, 6:1.3 ad 8:1.6 vel maxima ad 11:2.5-3 cm. magna, integerrima vel obscure repando-crenulata, superne cito glabrescentia vel fere glabra nervis lateralibus subimpressis, subtus dense albedo- vel subargenteo-sericeo-velutina, costa elevata glabrescente; petioli 4-14 mm. longi; amenta mascula 2-2.5:1.5 cm., feminea sub anthesi 2-3:1 cm., fructifera ad 4.5(-6):1.5 cm. magna; fructus submaturi 4.5-5.5 mm. pedicello ad 1.25 mm. longo glandulam $\frac{1}{4}$ ad duplo superante excepto longi; styli 1-1.5 mm. longi. 8. *S. bella*.

Ramuli hornotini et saepe etiam annotini plusminusve pilosuli vel tomentelli, nunquam (vel rarius levissime) pruinosi.

Folia subtus ut in *S. bella* velutino-tomentosa, obovata, obovato-oblonga, elliptico-oblancoolata vel rarius elliptica, apice obtusa vel (pleraque subito) late acuta, basi cuneata ad obtusa, majora latiora ad 6:3, oblongiora ad 8.5-9:2-2.8 cm. magna; petioli 5-10 mm. longi; stipulae in ramulis vegetis semiovato-lanceolatae, petiolo $\frac{1}{2}$ vel vix breviores; fructus elliptico-subrostrati, 5-7 mm. longi, pedicello ad 1.5 mm. longo excluso; styli 0.5-1 mm. longi.

. 9. *S. Drummondiana*.
Folia subtus ut in *S. subcoerulea* sericeo-tomentosa, anguste oblanceolata, apice obtusa ad acuta, basi cuneata, majora angustiora 6.5-9:1.2 vel ad 10:2.5 cm., latiora ad 5:1.3 cm. magna; petioli vix ultra 7-8 mm. longi; stipulae tantum in surculis distinctae, semicordatae, ad 11 mm. longae; fructus 4.5-5.5(-6) mm. longi pedicello ad 1.25 mm. longo excluso; styli 0.75-1 mm. longi.

. 10. *S. Jepsonii*.

ENUMERATIO SPECIERUM

1. *S. pulchra* Chamisso in Linnaea, VI. 543 (1831). — Coville in Proc. Wash. Acad. Sci. III. 319, t. 38 (1901), excl. syn. ex parte. — Ostenfeld in Dansk. Vidensk.-Selsk. Skrift. I. Math.-Nat. Kl. 1909. no. 8, 34 (Vasc. Fl. Arct. N.-Am. Gjöa Exp. 1904-6) (1910), excl. syn. ex parte. — *S. fulcrata* a. *subglauca* Andersson in De Candolle, Prodr. XVI.² 244 (1868). — *S. phyllicoides* Bebb in Bot. Gaz. XIII. 186, t. 10 (1888), pro parte maxima, non Andersson.

The type of this species came from Cape Espenberg, Alaska, and Chamisso also collected specimens on St. Lawrence Island. Not having seen the type which is preserved in the herbarium at Berlin, I rely on specimens from Port Clarence and St. Lawrence Island to supplement the ample description of the author. Judging by these specimens I believe that the typical form is one with glabrous or soon glabrescent twigs of which the one-year-old branchlets show very little or no trace of pubescence. But there occurs a pubescent form which I shall describe later. Chamisso's name *S. pulchra* has been overlooked by most of the salicologists; it is not even mentioned in the Index Kewensis, and in 1866 Wimmer & Krause described another *S. pulchra* which has nothing whatever to do with our plant. Andersson mentioned Chamisso's species only in 1858 (in Öfv. Svensk. Vet.-Akad. Förh. xv. 120) under *S. lapponum* to which he refers specimens collected by Beechey at Kotzebue Sound unknown to me, in the following manner: "Non sine hesitatione permulta hic refero Salicem eam 'pulchram,' de qua Chamisso, a se in America arctica pluries lecta, mentionem fecit. . . . Amenta sessilia, capsulae non pedicellatae, sed folia, fere ut in *S. phyllicifolia*, utrinque acutata viridia subtus pallidiora glaberrima, stipulae lineares persistentes. Unicum tantum specimen hujus formae ex herb. Berolinensi (a Chamisso lectum) vidi." In 1867 and 1868 Andersson does not mention this name, and I have not yet been able to discover to which species he referred Chamisso's specimen. He described, in 1858, a *S. phyllicoides* (in Öfv. I. c. 123) from specimens collected by Seemann: Awatcha Bay, "in arctica America occidentali." The Awatcha

(Avatcha, Avatchka, or Avacha) Bay is, however, as Coville (1901) already explained in southern Kamtchatka. On the northside of it is the harbor Petropavlosk where the ship "Herald," on which Seemann traveled, was in August 1848 when the type of *S. phylicoides* was collected according to the specimen in the Kew Herbarium. Andersson probably drew up his description from other specimens also collected by Seemann in the autumn of 1848 or 1849 in northwestern Alaska, but he does not cite them. In 1867, however, in his note to *S. fulcrata* (see later), the type of which has not been collected by Seemann, he mentions specimens of this collector without identifying them, and he cites, under *S. phylicoides*, only Seemann's plant from Awatcha Bay.

S. phylicoides has been regarded by Bebb (see later) as identical with the forms referred here to *S. pulchra*, but after having seen a good photograph and fragments of Andersson's type (Seemann, no. 1294, fr. im.; K.) I believe that it represents a different species not known from America. In *S. phylicoides* the stipules are, as Andersson correctly stated, small, linear-lanceolate, hardly more than 2 mm. long, and apparently deciduous or entirely wanting.

As to *S. fulcrata* Andersson (in Svensk. Vet.-Akad. Handl. vi. 139 [1867]) the following can be said. The author mentions as a synonym *S. cordata* var. Seemann, Voy. Herald 54, where only the locality "Fort Simpson to Bear Lake River" (Andersson quotes 'to Great Barelake') is given. The collector was Capt. W. J. S. Pullen. I have not seen this specimen, nor the one cited by Andersson of Stubbendorff from Kamtchatka. In his remarks Andersson says: "Hujus formae tantum specimina perpauca examinare mihi licitum fuit, ut de iis vix certi quidquam urgere audeam. *S. phylicoidi* et *S. chlorophyllae* sine dubio maxime est affinis." From both it differs by its large linear-lanceolate stipules. The leaves are said to measure from "3-4 pollices" in length being above the middle " $\frac{3}{4}$ -1 poll." wide. Such leaves may be observed on strong shoots of *S. pulchra*, and I believe that this American form of *S. fulcrata* can be regarded as identical with our species but I have not yet seen a specimen of *S. pulchra* from the region between Fort Simpson and Great Bear Lake or from any other part of the western Northwest Territories except a doubtful fragment of Richardson's from Fort Franklin (no. 64, Hb. H.B. & T., f., m.; N.¹). See also my remarks under *S. planifolia* the northwestern form of which seems to meet *S. pulchra* in the Mackenzie region.

If Andersson's fig. 73 on plate VII, in his monograph (1867) really represents the typical *S. fulcrata* it certainly does not fit the description because the stipules are not very large, linear-lanceolate and longer than the petioles but more or less ovate and as long as the petiole. Neither does the drawing agree with the Asiatic form which, in 1868, was made the type of *S. fulcrata* β . *subphylicifolia* of which the author expressly states that it "a vera *S. phylicifolia* . . . optime distinguitur stipulis petiolum brevem . . . saepe quadruplo superantibus." I doubt if this variety is identical

¹ For abbreviations for herbaria see footnote on p. 1.

with any American form, and I am unable to decide what the true *S. fulcrata* is. In 1868, Andersson described a form from "Ameriac arctica occidentali (B. Seemann, Hb. Hook.)" the type of his *S. fulcrata* a, *subglauc.* Fortunately I have a photograph and fragments of it (Seemann, no. 1789, in 1849, f.; K.) before me which show that it belongs to *S. pulchra*. This is the plant which Bebb (1888) in the explanation of plate X, figs. 1-7 calls "Seemann's plant, 'N.W. America,' type of *S. phyllicoides* and afterwards of *S. fulcrata*," while, as I have just pointed out, it is not the type of either species but only of *S. fulcrata subglauc.* In his remarks on this variety Andersson, strange to say, made the following statement (cited already by Bebb): "Huc forsan etiam pertinet *S. phyllicoides* And., Sal. amer. boreal. l. c. p. 123" but nevertheless he gives a full description of the last species on the following page in the Prodrum.

Coville (1901) accepted Bebb's critical investigation, but he was the first to restore the name *S. pulchra* of which Bebb apparently had no knowledge. Coville, however, thought it probable that the type of *S. phyllicoides* came from the American coast instead of from Awatcha Bay, but as I have shown above there is no reason for this.

S. pulchra ranges, as Coville already said, in Alaska from "the islands of Bering Sea to Point Barrow on the Arctic Coast, to Kodiak Island on the south coast, and to the upper Yukon valley in the interior." In the north I have seen it from as far east as Herschel Island and Dawson in the Yukon Territory, and Lake Bennett in the northwestern corner of British Columbia. As already mentioned it may occur as far east as Fort Franklin and Fort Simpson, but the specimens from these regions are uncertain. Coville also quotes a specimen from the Siberian Coast which I have not yet seen.

There are a good many specimens which differ from the type by their densely hairy branchlets, and I propose the following variety:

1b. *S. pulchra*, var. *yukonensis*, var. nov. — A typo nonnisi differre videtur ramulis novellis dense griseo- vel flavescenti-villoso-tomentosis (pilis vix $\frac{1}{2}$ mm. longis), annotinis plerisque etiam satis dense sed interdum tantum partim tomentosis, vetustioribus saepissime glabris et nitidulis, ut in typo castaneis vel intense purpurascensibus.

TYPE LOCALITY: vicinity of Dawson, Yukon Territory.

SPECIMENS EXAMINED: YUKON TERRITORY: vicinity of Dawson, June 26, 1914, *A. Eastwood* (no. 373, fr. submat., type; A.); June 11, 1914, *A. Eastwood* (No. 181, st.; 182., fr.; A.); May 7, 9, and 14, 1914, *A. Eastwood* (Nos. 37, f., 40, m., 55, f.; A.; amentis praecocibus in ramulis sordide flavescenti-tomentosis); June 9, 1914, *A. Eastwood* (No. 171, st.; A.); June 23, 1914, *A. Eastwood* (No. 359, st.; A.); along Forty Mile Creek, near Yukon River, May 26, 1893, *F. Funston* (No. 40, f.; W.).

ALASKA. Rampart on the Yukon, low marshy ground, May 26, 1901, *J. Jones* (No. 2, m.; W.; "tree 6 to 9 ft., bark on trunks and old wood rough and dark in color, new wood smooth and shiny bright brown"; a fruiting specimen under the same number is typical); June 16, 1901, *J. Jones* (No. 21, fr. im.; W.); along river bank, June 5, 1905, *J. Jones* (No. 5, f.; W.); Vicinity of Cape Lisbourne, Collie River, July 27, 1904, *C. Washburne* (fr.; W.; "not seen over 4 or 5 inches in height"); Copper River region, along river banks, June 23, 1902, *W. L. Poto* (No. 58, fr.; W.; "slightly

inclined to be bushy, 8 feet high"); ridge north of camp 8/5-8, 1150 m., common at high elevations, August 8, 1902, *W. L. Poto* (No. 131, fr.; W.; "1-2 ft. high").

The systematic position of *S. pulchra* is by no means certain to me. As already stated it differs from all the other Willows of this group by the development of large persistent stipules, a character found in species like *S. Richardsonii* to which var. *yukonensis* bears a certain resemblance, but *S. Richardsonii* has a much more hirsute pubescence and glabrous ovaries.

2. *S. phylicifolia* Linnaeus, Spec. II. 1016 (1753), exclud. var. β . — For further literature see Schneider in Sargent, Pl. Wils. III. 123 (1916). — The first author who adopted Linnaeus' name for an American Willow was Tuckerman (1843), who was followed by Carey (1848) as stated later under *S. planifolia*. When, in 1858, Andersson commenced his study of American *Salix* he referred Carey's plant with a query to what he then called *S. (phylicifolia*) discolor*, and said: "Specimina numerosa, quae attente examinavi, parum differunt a vera *S. phylicifolia* . . ." In 1867, however, he proposed *S. chlorophylla* for these forms, saying "est species parum dubiae affinitatis, ut jam propositum est, inter *S. discolor* americanam et *S. phylicifoliam* boreali europaeam evidentem ambigans, nunc illi nunc huic adscripta." In the 5th edition of his Manual (p. 464 [1867]) Gray followed Andersson in taking up the name *S. chlorophylla*, but Bebb who (in 1889) studied the matter, first expressed the opinion that the differences between *S. phylicifolia* and *S. chlorophylla* given by Andersson did not exist. He said: "Carey, Tuckerman, Barratt and all the early New England botanists were quite right in referring the plant in question to the old Linnean species." Therefore, in the 6th edition of the Manual, Bebb reinstated the name *S. phylicifolia* but, as explained later, his own remarks prove that he was not fully convinced of the identity of the two plants. Robinson & Fernald (1908) and Britton & Brown (1913) also have adopted the name *phylicifolia*.

In 1899, Ball dealt with the 'western' *S. chlorophylla*, and he explained "the story of the confusion of *S. phylicifolia* and *S. chlorophylla*." He came to the conclusion that the typical *S. phylicifolia* is only found in Labrador, and that "the few White Mt. specimens examined, though old and imperfect, present a decidedly American variation towards the Rocky Mt. form." Ball gave a comparison of *phylicifolia* with *chlorophylla*, but, at that time, he, apparently, was very imperfectly acquainted with the eastern forms. To decide the question whether or not the true *S. phylicifolia*, or a form inseparable specifically from it occurs in North America we must determine the characters by which this species is to be recognized.

Linnaeus' type is "351. *Salix* foliis serratis glabris lanceolatis, crenis undulatis" in his Fl. Lap. 283, t. 8. fig. d (1737). From his description I take the following characters: ". . . ramuli recentes purpurascetes. Folia lanceolata, glabra, distincte serrata, . . . superne saturate viridia, nitida . . ." S. J. Enander, the foremost living salicologist (in his Stud. Salices Linnés Herb. 17, no. 7a, and 83, no. 89 [1907]) has not only given an exact description of the material of *S. phylicifolia* preserved in Linnaeus'

herbarium, but he has also distributed among his *Salic. Scand. Exsiccatae* under no. 118 $\frac{1}{2}$ a photograph of "*Salix phylicifolia* L. originalis et typica," and besides this under no. 116, 117 and 119 a-c he has distributed male and female specimens of what he regards as typical *phylicifolia*. Therefore I base my judgment as to the characters of this species on Enander's specimens and descriptions. Of the so-called American *phylicifolia* I have all the material before me that can, possibly, be brought together from existing collections.

In 1868, Andersson said under *S. chlorophylla*: "Cum nostra *S. phylicifolia* congruit forma et colore foliorum ut etiam habitu amentorum sessilium, sed differt foliis pilis argenteis plus minusve dense conspersis etiam demum subderelictis, amentis angustioribus et compactionibus, capsulis subsessilibus, stylo multo longiore (saepae capsulae longitudine aequante et filiformi), stigmatibusque elongatis integris." He believed his var. *denudata* to be most closely related to *phylicifolia*, saying: "Jam monui me specimina *Salicis* a White Mountains vidisse quae nullo modo, nisi foliis ellipticis integerrimis, a nostra *S. phylicifolia* recedunt. Num hujus speciei forma maxime *denudata*?" In 1889, Bebb, as I have already pointed out, declared that these differences mentioned by Andersson had not been confirmed by his investigations. He had compared material from Lapland, collected by Dr. Hankenson, which he, at first, could not distinguish from specimens collected by Faxon in the White Mountains. But a few months later in the same year (in *Bull. Torr. Bot. Cl.* xvi. 211), in a note, Bebb made the following statement: "Concerning the general character of the White Mountain *S. phylicifolia*, my remarks were unguarded and do not fairly state the amount of actual divergence from the Old World type. While I do not wish to qualify at least what was said of the closeness of resemblance observed between some of Mr. Faxon's specimens and certain others of genuine *phylicifolia* from Lapland, it is nevertheless true that from the common meeting ground thus indicated, the European forms vary mainly in the direction of *S. nigricans*, *S. caprea*, etc., whereas in this country the variation is in the direction of *S. chlorophylla*, and hence in so far as any difference appears in a series of specimens, it is a difference marked by shorter pedicels, longer styles, and more slender aments. I intended my closing words to cover this, but was not sufficiently explicit." I have investigated the Lapland material which Bebb had before him. It is preserved in his herbarium in herb. C. under Nos. 11449-11452 from Prteå (?), Gustafsho, and Skadsön (?), collected at different times during 1879, 1883, 1885 and 1886. The differences are not very obvious but a careful comparison shows that these forms are distinguished by larger fruits, larger and thicker fruiting aments, more distinctly crenate leaves, and especially by the fact that the larger leaves point to forms different from those observed in America. In my key I have tried to indicate the main differences between *S. phylicifolia* sensu stricto and *S. chlorophylla denudata* (now *S. planifolia*). The young branchlets of the American species very often show, more or less distinctly, a glaucous hue which never seems to be present in *S. phylicifolia*.

of which the dried twigs are less decidedly blackish purple. That the pubescence of the European species sometimes also shows a mixture of bright red brown hairs is expressly stated by F. B. White (Jour. Linn. Soc. xxvii. 396 [1890]).

There seems to be no doubt that *S. planifolia* is closely related to *S. phylicifolia* but the only American specimen I have seen which might represent typical *S. phylicifolia* is a sterile one collected by Fernald & Wiegand at Brigus Junction in the southeast corner of Newfoundland, August 5, 1911 (No. 5272; G.). Without flowers or fruits I am unable to decide the identity of this plant, but I suspect that it belongs to *S. discolor* to which species Fernald refers a specimen collected by him and Wiegand at St. Johns a few miles east of the former locality, August 1, 1911 (No. 5256, st.; G.).

3. *S. paraleuca* Fernald in Rhodora xvi. 175 (1914). — *S. stenocarpa* Fernald, l. c. 176, non Gandoger, 1890. — Professor Fernald agrees with me that *S. stenocarpa* cannot be separated from *S. paraleuca*; the differences pointed out by him are too insignificant and disappear entirely in certain specimens. This species of which the male plant is still unknown needs further study. Its existence again proves how rich the Gaspé region is in endemic species.

SPECIMENS EXAMINED: QUEBEC. Gaspé Peninsula, Gaspé District, banks of the Grand River, June 20–July 3, 1904, M. L. Fernald (fr. type of *paraleuca*; G.). Bonaventure District, Matapedia, ledgy banks of Restigouche River, June 28, 1904, M. L. Fernald (fr. type of *S. stenocarpa*; G.).

4. *S. planifolia* Pursh, Fl. Am. Sept. ii. 611 (1814); ed. 2. ii. 611 (1816). — Poiret in Lamarck, Enc. Suppl. vi. 62 (1817). — Hooker, Fl. Bor.-Am. ii. 150 (1839), tantum pro parte minima. — *S. phylicifolia* Tuckerman in Am. Jour. Sci. Arts, xcv. 35 (1843), non Linnaeus. — Carey in Gray, Man. 428 (1848); ed. 2. 416 (1856). — Bebb in Bull. Torr. Bot. Cl. xvi. 39 (1889); apud Watson & Coulter, Gray Man. ed. 6. 484 (1890). — Britton & Brown, Ill. Fl. i. 502, fig. 1195 (1896); ed. 2. i. 600, fig. 1475 (1913). — Ball in Trans. Acad. Sci. St. Louis ix. 83 (1899). — Robinson & Fernald, Gray's Man. 328, fig. 668 (1908). — *S. (phylicifolia*) discolor* Andersson in Öfv. Svensk. Vet.-Akad. Förh. xv. 123 (1858), pro parte. — ? *S. arbuscula labradorica* Andersson, l. c. 130. — *S. chlorophylla denudata* Andersson in Svensk. Vet.-Akad. Handl. vi. 138 (1867); in De Candolle, Prodr. xvi.² 244 (1868). — *S. chlorophylla* Gray, Man. ed. 5, 464 (1867), prob. haud Andersson sensu stricto. — Macoun, Cat. Can. Pl. I. 446 (1886). — Britton, Man. 318 (1901); ed. 2. 318 (1905).

Pursh's description is very short and is based on specimens from Anderson's¹ garden which had been introduced from Labrador. There is, in my

¹ It may be stated that this is George Anderson, an English salicologist (see Britten & Boulger, Biogr. Ind. Brit. Bot. 4 [1893]) who is not to be confounded with N. J. Andersson, the Swedish botanist, as apparently the printer did in my second note in Bot. Gaz. LXvi. 343, when he changed Anderson into Andersson.

opinion, only one species among the Willows of Labrador to which the description can be applied, namely the so-called *S. phylicifolia* or *chlorophylla*. Pursh says: "*S. erectiuscula, divaricata; ramulis laevigatis, foliis oblongo-lanceolatis utrinque acutis medio serrulatis glaberrimis patentibus glaucis discoloribus, stipulis nullis.*" "This singular species distinguishes itself at first sight by its plain and patent leaves; it is inclined to rise from the ground on a single low stem, and approaches to the following division" (*caule erecto*). Professor Fernald agrees with me that there is nothing in this description that does not fit the species for which I now take up this name.

Hooker (1839) referred to *S. planifolia* specimens from Labrador collected by Miss Brenton. According to a photograph and fragments before me they belong to *S. cordifolia* Pursh. (See my remarks in Bot. Gaz. LXVI. 344, [1918].) Hooker also mentions specimens collected by Richardson in the Northwest Territories and by Drummond in the Rocky Mountains, of which No. 58 Hb. H. B. & T. in N. from Fort Franklin seems to represent Richardson's plant. Of this number some sterile pieces apparently belong to *S. planifolia* while others (partly with fruits) represent *S. glauca glabrescens* (And.) Schn. Of Drummond's specimens I saw a photograph and fragments (Herb. K.). The locality is "Lac la Pierre" which I have been unable to find on any map at my disposal. Andersson determined two sterile pieces marked (no. 1) quite correctly as *S. Richardsonii* and referred the four others (no. 2) to "*S. glauca (villosa glabrata)*" having apparently in mind his *glaucops glabrescens* now *glauca glabrescens* to which the male, the fruiting pieces and the remaining two sterile ones seem to belong. Hooker also mentions a var. "*foliis unicoloribus*" without indicating a type, only saying " β , though not marked as a var. by Barratt, has the leaves of the same color on both sides, and decidedly serrated." I suspect that this form belongs to one of the *Cordatae* group.

As the type of Andersson's *S. chlorophylla* has to be taken his var. *vestita* for which he, unfortunately, did not indicate a type specimen. He, probably, based it, at least partly, on specimens collected by Richardson at "Norway House Fort," because he cites as the first synonym Hooker's *S. discolor* β . (Fl. Bor.-Am. II. 147 [1839]) of which Richardson's plant is the type. I have not yet seen it. Andersson's second synonym, "*S. (phylicifolia) discolor* Ands." "p.p." for the most part belongs to *S. discolor* Muhl., but there are specimens in Herb. N. which partly represent *S. discolor*, like those collected apparently by Bourgeau, "Lac Winnipeg 26 Juin," and partly are very like *S. planifolia*. The sheet on which they are mounted has also a label in Andersson's handwriting: "Specimina hacce, habitu et characteribus *S. nostram phylicifoliam* omnino simulant mihi tamen ad *S. discolor* pertinere videntur." According to a note on the sheet these specimens have been regarded as the type of *S. chlorophylla*, but one of them is clearly a very glabrescent *S. discolor* while the other has the fruits of *S. planifolia* although the young twigs are rather densely villose, and even the one-year-old branchlets show distinct traces of pubescence. The half-

grown leaves are narrowly oblanceolate, at first sparsely pubescent with grayish and fulvous hairs, very soon becoming glabrous (except a few hairs on the midrib of the upper side). This plant, therefore, does not agree with var. *vestita*, and probably represents a form closely related to *S. planifolia*. I am not yet sure whether Andersson's var. *vestita* is only a form of the latter or has to be regarded as a distinct species. See also my remarks under *S. pellita*, p. 82.

In 1867, Andersson furthermore described as a "varietas singularis" *S. chlorophylla* **S. pychnocarpa* from specimens collected by Bourgeau "ad Carlton-house" which, in 1868 he called *S. chlorophylla* δ . *pychnocarpa*. In his note (1867) he said: "Est forma valde singularis ad sequentem [*S. pellitam*] transitum evidentissimum efficiens. Frutex non altus videtur, ramis glaberrimis fusco-castaneis. Foliis iis *S. chlorophyllae* sat similia sed fere angustiora et subtus tomento haud denso subargentea; amenta ut in *S. grisea* et capsulae eximie condensatae ut fere undique divaricatae adpareant." I have seen a photograph and fragments of a specimen collected by E. Bourgeau at "Carlton, bord de la rivière, 6 Mai 1858" (No. 13, m., f.; K.). The flowers generally agree with those of *S. planifolia* but the filaments are sparsely pilose, and, owing to the absence of leaves, I cannot decide whether it belongs to one of Andersson's forms or to *S. pellita* (see later). It certainly does not represent the type of var. *pychnocarpa*. Of this form Bebb (1889) spoke as follows: "The characters specified by Prof. Andersson as serving to distinguish his *S. chlorophylla* from the Old World *S. phylicifolia*, are most noticeable in the Rocky Mountain *S. chlorophylla* var. *pynostachya* (sic!) . . ." So far as I can judge by Bebb's statement he did not see Andersson's type but was entirely guided in his deductions by the description. The type came from Carlton in central Saskatchewan, and before we can judge its relationship it is necessary to investigate what the typical *S. chlorophylla* (var. *vestita*) is. This cannot be done without comparing the types of Andersson which, if at all, must be preserved in the Hookerian Herbarium (K.) or in the herbarium at Stockholm or Upsala.

I have seen material of typical *S. planifolia* (*S. chlorophylla denudata*) from Labrador (where the most northern point of its known distribution seems to be Nain), northeastern Quebec (Saguenay County, as far north as Lake Mistassini, Rupert Land, J. M. Macoun, No. 24706, O.; m., f., and the Gaspé Peninsula), Maine (Mt. Katahdin), New Hampshire (White Mountains) and Vermont (Mt. Mansfield). In addition to these I have before me the following specimens from Keewatin and the Northwest Territories which come very near *S. planifolia*. The most typical one is a specimen collected by J. W. Tyrull at Chesterfield Inlet on the southwestern coast of Hudson Bay, September 11, 1893 (No. 1763, fr.; O.). The twigs are glabrous, the fruits measure up to 7 mm. in length, and the leaves possess a good many stomata in the upper surface, which seem to be entirely wanting in the leaves of the type. More different is J. M. Macoun's (No. 179153, O.; fr. adult.) from Churchill on Hudson Bay. Here the fruits are up to 8 mm. long, and the young twigs are more or less covered with a short.

pubescence of grayish and fulvous hairs. From Churchill is also E. A. & A. E. Preble's No. 23, st.; W. which looks rather typical. In other fragments brought by J. W. Tyrull from the region between Athabasca and Chesterfield Inlet, August 11, 1893 (No. 1763^a, O; fr. juv.) and September 1, 1893 (No. 1763^b, O.; fr.) the pubescence of the twigs is less developed and the leaves are even more narrowly lanceolate. Seton & Preble collected a specimen in the region of Great Slave Lake and near Stone Island, July 14, 1907 (No. 37 [=78399, O], fr.). It has larger aments (up to 5.5:3 cm.), and the fruits are about 7 mm. long with a style 1 mm. in length. Another specimen is A. E. Preble's from Fort Resolution, July 14, 1901 (No. 143, st.; W.). The same collector brought some more specimens from the Mackenzie River in 1904. One, collected at Fort Norman, June 12 (No. 322^a, fr. im.; W.), has half-developed young leaves without any stomata in their upper epidermis and no trace of stipules. It looks like typical *S. planifolia*. The others came from Fort Simpson, May 12 (No. 303^B, f; W.) and May 15 (No. 305, m. and st., with very young leaves; W.) In the male flowers the bracts are acute, otherwise there seems to be no difference between the last two numbers and No. 322^a. I have suspected that *S. pulchra* might grow in this region, but I have not yet seen specimens of it from the Northwest Territories except very poor and uncertain fragments mentioned under *S. pulchra* on p. 71, which after all may be referable to *S. planifolia*; but the Mackenzie region is, probably, the meeting ground of these species.

It is possible that typical *S. planifolia* also occurs in the northern Rocky Mountains from Alberta to northern Wyoming. On the other hand the western form hereto referred to *S. chlorophylla* seems to represent a distinct variety. The name *S. chlorophylla* cannot be used, and the majority of the western specimens before me (I have a well-collected representative series at hand) are most closely related to *S. monica* Bebb. This species is nothing but the dwarfed high alpine form of this western variety for which I propose the name.

4b. *S. planifolia* var. *monica*, nov. var. — *S. monica* Bebb in Watson, Bot. Cal. II. 90 (1879); in Bot. Gaz. XVI. 107 (1891). — Ball in Trans. Acad. Sci. St. Louis, IX. 84 (1899). — Jepson, Fl. Cal. I. 344 (1909), pro parte. — Hall, Yosemite Fl. 69 (1902), prob. tantum pro parte. — *S. chlorophylla* Bebb¹ in Coulter, Man. Rocky Mts. Bot. 337 (1885). — Porter & Coulter in U.S. Geol. Surv. Misc. Publ. no. 4. 128 (Syn. Fl. Colo.) (1874). — Macoun, Cat. Can. Pl. I. 446 (1886), pro parte. — Nelson in Bull. Wyo. Exp. Sta. XXVIII. 179 (1st Rep. Fl. Wyo.) (1886). — Ball in Trans. Acad. Sci. St. Louis, IX. 83 (1899), excl. syn.; in Coulter & Nelson, New Man. Rocky Mts. Bot. 137 (1909). — Rydberg, Fl. Colo. 96 (1906); Fl. Rocky Mts. 198 (1917). — Daniels in Univ. Mo. Stud. Sci. Ser. II. 248 (Fl. Boulder, Colo. 100) (1911).

Bebb described his species from "poor stunted specimens" collected by Bolander at Mono Pass Summit. The real collector was probably W. H.

¹ Bebb and the following authors also include the forms of the northern Rockies which, as I have already stated, may, at least partly, be referable to the typical eastern *S. planifolia*.

Brewer, and his No. 1732 from the given locality, June 27, 1863, of which I have seen specimens in Herb. G. and W., represents the type number. There are, however, only female specimens under this number. Later (1891) Bebb thought it would be best to drop "a species of such questionable validity" which possibly might represent a form of *S. chlorophylla*. Ball (1899) discussed the question, and suggested "that the staminate aments of *S. monica* with their linear scales, may be found to belong to some other species" but he had not seen Bebb's type. Jepson (1909) mixed *S. monica* with forms with glabrous ovaries that really belong to a variety of *S. Eastwoodiae* Cock. He, however, collected good flowering material at the type locality on July 19, 1911, at an altitude of about 3500 m. (No. 4466, m., f.; A.) which is identical with Brewer's No. 1732. The difference of the bracts of the male and female flowers alluded to by Bebb cannot be observed in Jepson's plants. The scales of both the sexes are narrowly oblong to ovate-lanceolate, and in the male plant only somewhat more acute; after all their shape is variable to a certain degree in both plants. The aments are from subglobose to short-cylindric, the female measuring up to 1.5:1 cm., while the male are subglobose and hardly more than 1 cm. long and thick. In the young leaves the different (glaucous) color of the lower surface is scarcely visible, and only the lowermost (first) leaves are sometimes covered beneath with a few silky hairs. The number of stomata is almost equal in the epidermis on both surfaces. There are a few remaining old leaves of a narrowly elliptic or oblanceolate shape which measure up to 22:9 mm. The style is a little longer (up to 0.8 mm.) than in Brewer's No. 1732, and the ovaries are subsessile in both, the very short pedicel being about half the length of the gland. On July 14, 1899, Jepson already had collected a very similar form on the saddle of Mount Dana, at the same altitude (No. 3308, fr.; A.) with a few old male aments, and rather adult female aments, and also with almost fully developed narrowly or broadly elliptic or obovate-elliptic leaves measuring up to 2:1 cm. They are more or less distinctly glaucous beneath; the lowest ones bear some fulvous silky hairs beneath, and the youngest show a scanty pubescence on both surfaces soon becoming glabrous. The main difference between these specimens and those mentioned above is found in the ovaries which have a more distinct pedicel which in the oldest flowers is somewhat longer than the gland.

In describing his *S. pennata* (see later) Ball said that "little *S. monica* is found in the central Sierra Nevada." I have carefully compared many specimens from the Rockies referred to *S. chlorophylla*, and there are quite a number among them, especially from high alpine regions in Colorado, which I cannot distinguish at all from typical *S. monica*. They also are provided with numerous stomata in the upper surface of the leaves, and often have short styles hardly as long as the stigmas. The leaves, as a whole, are smaller and broader, more elliptic or obovate-elliptic than in the eastern type, but the shape is rather variable, and seems not to afford a good taxonomic character. Such forms are for instance: J. H. Cowen's

No. 470, Colorado, mountains northwest of Boreas, Summit County, mountain slopes near timber line, about 3500 m., August 2, 1895 (f., fr. juv.; N., W.), and C. L. Shear's No. 4280, Mt. Blanca, Costilla County, about 4300 m., July 31, 1900 (fr. ; N., W; "spreading, 2 ft. high"). They gradually pass into the more vigorous forms with stouter aments and larger leaves which have more or less numerous stomata in the epidermis of the upper surface until we come to forms in Wyoming (like Albany County, August 23, 1904, *F. V. Coville*, No. 2070, fr.; W.) and in Alberta (Calgary, June 5, 1897, *J. Macoun*, No. 94427, O., fr.; stomata in pagina superiora non visa; and Jumping Pound Creek, June 12, 1897, *J. Macoun*, No. 94425, O., st; magis intermedia inter var. *typicam* et var. *monicam* videtur) which I am at a loss how to distinguish from certain forms of the White Mountains, New Hampshire. A vigorous western specimen does not look more different from the typical dwarf high alpine var. *monica* than an eastern specimen, grown in a protected situation in the Great Gulf on Mt. Washington, diverges in habit, etc., from the "depressed and prostrate shrub, seldom rising more than one foot from the ground" (Faxon) in exposed situations of the Alpine Garden on the same mountain, where I had an opportunity to observe it myself in September 1918. Therefore, I leave it, at present, an open question where the line can be drawn between the range of the type and var. *monica*. I have seen specimens which I refer (partly only provisionally) to this variety from California (Mono and Tuolumne Counties), Utah (Salt Lake, Wasatch, Duchesne or Summit, and Sevier Counties), New Mexico (Mora County), Colorado (through the Rockies from Costilla to Larimer County), Wyoming (Albany, Frémont, Sheridan Counties, and Yellowstone Park), Montana (Madison and Park Counties), to Alberta (see above). There is a specimen said to have come from the "interior of Washington Territory," 1841, *C. L. Pickering & W. O. Breckenridge* (Wilke's Exped. No. 481, f.; N., W.) which had been in 1909 named *S. chlorophylla* by Ball (W.) who in 1915 cites it under his *S. pennata*. Judging by Piper's remarks (Fl. Wash. 15) as to the labeling of this collection it seems that the locality is not correct. It does not look to me like *S. pennata* but is extremely alike var. *monica* sensu meo. While on the other hand, the *chlorophylla* mentioned by Bebb (1891) as occurring "on Mt. Adams and the higher summits of the Cascades" is *S. pennata*.

In 1905 (Bot. Gaz. XL 379, t. 13, figs. 8-11) Ball described a *S. Nelsonii* the type of which was collected by A. Nelson on Laramie Peak, Albany County, Wyoming, along creek, July 13, 1890 (No. 7580, fr.; L.). Professor A. Nelson has kindly loaned me all the material from Herb. L. I a'so have had an opportunity to discuss this plant with Mr. Ball, who tells me that he is now inclined to believe that *S. Nelsonii* is nothing but a form of *S. chlorophylla* (= *S. planifolia*). In his remarks with the original description Ball said that *S. Nelsonii* "is most closely related to *S. chlorophylla*" but that "it is readily distinguished by the oblanceolate leaves which, when mature, are prominently nerved above and reticulated beneath." In his treatment of the Rocky Mountain Willows (apud Coulter &

Nelson, New Man. 137 [1909]) Ball contrasted the two Willows as follows: leaves broadly elliptic-ovate or obovate, mostly obtuse at apex; styles 1-1.5 mm. long: *S. chlorophylla*, and leaves oblanceolate, acute at both ends, styles 0.5-1 mm. long: *S. Nelsonii*. I have been able to examine most of the specimens enumerated by Ball, and I believe that almost all of the Colorado specimens and Tweedy's No. 47 from the Bighorn Mountains in Wyoming are not separable from *S. planifolia monica* and *typica*. But in specimens of A. Nelson and E. Nelson named by Ball *S. Nelsonii* I find that the color of the one-year-old branchlets is more brownish red and not chestnut colored as in *S. planifolia* and that the narrower lanceolate or oblanceolate leaves very often show a rather distinct but fine glandular crenulate denticulation. Their nervation is about the same as in *S. planifolia*, and Ball's statement (1909) that the mature leaves are "rather strongly veined on both surfaces" applies as well to certain specimens of *S. planifolia*. J. G. Jack collected at Centennial, Wyoming, at an altitude of about 2700 m., on August 19, 1918 (Nos. 1068, 1069, st.; A.; "bushes 6-8 ft. high, stems yellow or purplish green") good material of a form with ovate-lanceolate or narrow-lanceolate (sometimes oblanceolate), rather acuminate leaves which are more or less distinctly crenate-serrate, firm, and prominently nerved beneath. This form, too, seems to represent typical *S. Nelsonii* which, after all, may be regarded as another variety of *S. planifolia* more closely connected with var. *typica* than with var. *monica*. There is no male material of *S. Nelsonii* known, and before I dare express a definite opinion on it, I must study a larger set of specimens, and get a better understanding of the forms of the Athabasca Region and the Northwest Territories which I mentioned on p. 77. Some of these forms closely resemble *S. Nelsonii* which has been quite amply described by Ball, but he says: "stipules none" while the type specimen as well as A. Nelson's No. 8822 are provided with distinct lanceolate or ovate-lanceolate rather acute, glandular-denticulate stipules which are 2 to 4 mm. long. Jack's Nos. 1068 and 1069 show the same kind of stipules which become dry and fall off later.

All the forms of *S. planifolia*, and especially *S. Nelsonii*, need a careful study in the field. Without having before me young material of both sexes and mature leaves and fruits of the same individuals I am not able to decide the taxonomic value of *S. Nelsonii*. There are some sterile specimens which look much like *S. monticola* Bebb but may be referable to a form like *S. Nelsonii*. I shall deal with them later.

5. *S. pennata* Ball in Bot. Gaz. LX. 45, fig. 1 (1915); in Piper & Beattie, Fl. Northwest Coast, 117 (1915). — *S. chlorophylla* Bebb in Bot. Gaz. xvi. 107 (1891), pro parte, non Andersson. — Piper in Contr. U.S. Nat. Herb. ix. 216 (Fl. Wash.) (1906). — This rather rare and local species has been amply described by Ball but he states that the filaments are "glabrous," while I find that they are distinctly but minutely pilose at base in all the flowers I have examined. In this character *S. pennata* differs from all the species included by me in this section to which it otherwise shows the

closest relationship. Ball says: "In relationship it lies between *S. chlorophylla* and *S. pulchra*, geographically, also, it occupies a position between these two species." He states that on a sterile shoot (Applegate, No. 2758, Oregon, Marion County, 10 miles west of Olay Butte, September 4, 1898) stipules were present and 4-8 mm. long. I did not see this specimen, and on the shoots of such specimens as W. N. Suksdorf's No. 9271, Washington, Skamania County, Chiquash Mts., August 12, 1886, there is hardly a trace of stipules, while on the specimens of Jack cited below, the youngest leaves have ovate-lanceolate stipules of about half the length of the petioles.

The type of *S. pennata* was collected by W. N. Suksdorf on Mount Paddo (Adams) in Washington, and it also has been found in Washington by J. G. Jack in Pierce County, Mt. Rainier, Longmire Springs, on August 20, 1904. It is also known from Mt. Hood, Hoods River County, and from Marion County, Oregon (see above).

6. *S. pellita* Andersson in Svensk. Vet.-Akad. Handl. vi. 139, t. 7, fig. 72 [excl. fig. sinistra gl] (Monog. Salic.) (1897), quasi subspecies *S. chlorophyllae*, pro parte. — Ball in Trans. Acad. Sci. St. Louis, ix. 81 (1899) pro parte. — Fernald in Rhodora vi. 191 (1904). — Robinson & Fernald, Gray's Man. 327, fig. 667 (1908). — Britton & Brown, Ill. Fl. ed. 2. i. 598, fig. 1468, (1913). — Rydberg, Fl. Rocky Mts. 197 (1917), pro parte. — *S. chlorophylla* β. *pellita* Andersson in De Candolle, Prodrum xvi.² 244 (1868), pro parte. — As Fernald (1904) has already explained in his note on "the identity of Andersson's *Salix pellita*," this author mixed two different plants in basing his new species on specimens from Lake Winnipeg, collected by E. Bourgeau, and also on a Rocky Mountain plant found by Lyall. The first which has to be taken for the type represents an eastern species while the second is *S. subcoerulea* Piper. Until Fernald pointed out this fact, the eastern form usually has been referred to *S. candida* Fluegge from which, however, *S. pellita* is easily separated by its different shining velvety or silky pubescence while *S. candida* possesses a "dull whitish lanate or flocculent tomentum" (Fernald). As to the differences between *S. pellita* and *S. subcoerulea* see under this species.

When Andersson described *S. pellita* he made it a quasi subspecies of *S. chlorophylla* saying: "Difficile sane est adjudicatu cuinam Salicum formae magis sit affinis," and he thought that it probably might be a "modificatio maxime tomentosa" of *S. chlorophylla* "aut e *S. chlorophylla* et *sericea* hybrida." As I have already stated I do not yet know what the typical *S. chlorophylla* (id est var. *vestita*) really is. It came from the same region (Winnipeg) where it also was collected by Bourgeau, and Andersson's description of it is: "— *vestita*: foliis initio utrinque, praecipue subtus tomento argenteo micante obtectis; capsulis fere sessilibus obtusis, dense argenteo-lanatis." From this diagnosis I strongly suspect that the typical *chlorophylla* may turn out to be almost identical with *S. pellita*, in which case the first name would have to be used for it. From Andersson's remarks quoted above I can only surmise that he was far from having a good idea

of the real relationship of these intricate forms. He had before him nothing but a few specimens which were in part at least rather poor, and it is not surprising that frequently he was not able to understand the scanty material upon which he based his opinions.

I have seen forms which I refer to *S. pellita* from southern Labrador (Fernald & Wiegand, No. 3182, st.; G., O.; forma quamvis incerta, porro observanda), western Newfoundland, New Brunswick (as far north as Woodstock in Carleton County), Maine (Aroostook and Somerset Counties), Vermont (Bloomfield in Essex County), and westward from Quebec (as far north as Lake St. John), Michigan (Isle Royale, Houghton County), Ontario (Savanne, Thunder Bay County), and the Lake Winnipeg region. These specimens include the type and the glabrescent form for which I propose the name *S. pellita* f. *psila*,¹ nov. forma: a typo ut videtur nonnisi differt foliis normalibus tantum novellis plus minusve pilosis citissime glabris. — For the type I take Fernald & Wiegand's No. 5282, from Newfoundland, Valley of Exploits River, Grand Falls, thickets along river, July 4, 1911 (fr.; G.). It seems to be associated with the type everywhere in the northeastern part of its habitat from Newfoundland through northern Maine, the Gaspé Peninsula to the Quebec District in Quebec. I do not think it represents a good variety but is apparently connected with the typical form by many intermediates. In a young state, if the branchlets are not pruinose, it is much like *S. planifolia* but it differs a good deal from that species in the shape of the narrowly lanceolate leaves. Some specimens the leaves of which show a rather distinct reticulation beneath and are a little more rugulose, too, on the upper surface, look not unlike the glabrous form of *S. candida* which is called var. *denudata* Andersson, but this form usually shows distinct traces of the peculiar pubescence of *S. candida* on the branchlets.

There may be hybrids with species with which *S. pellita* is growing, and I am at present unable to interpret properly some specimens before me. Among them are the following collected by Fernald & Wiegand which Fernald has determined as *S. phylicifolia*. In part they are nearly identical with *S. pellita psila*, and in part they look like a very narrow-leaved form of *S. planifolia* of which I have not yet seen the typical form from Newfoundland. The specimens came from Birchy Pond Stream in the eastern drainage area of the Humber River system, July 11, 1910 (No. 4239, fr.; A., G.; "shrub 1-4 m. high"; very similar to var. *psila*); river bank between Mt. Musgrave and Humber Mouth Bay (Bay of Islands Station), July 15, 1910 (No. 3190, fr.; G.; looks a little more like *S. planifolia*), and Laurentian area at the head of Exploits River system, granite barrens, slopes and summits of hill near Quarry, July 7, 1911 (No. 5270, fr.; G.; as the preceding). The pubescence of the young shoots is partly ferrugineous. In a later note I shall discuss under *S. humilis* Marshall a form from Quebec, Newfoundland and New Brunswick of which the pubescence of the leaves closely simulates that of *S. pellita*.

¹ Derived from $\psi\lambda\delta\varsigma$, with little hair.

7. *S. subcoerulea* Piper in Bull. Torr. Bot. Club xxvii. 400 (July, 1900),¹ excl. specim. Torreyi No. 489. — Ball in Coulter & Nelson, New Man. Rocky Mts. Bot. 136 (1909). — Wootton & Standley in Contr. U.S. Nat. Herb. xix. 161 (Fl. N. Mex.) (1915). — Henry, Fl. S. Brit. Col. 99 (1915). — Rydberg, Fl. Rocky Mts. 197 (1917). — *S. cuneata* Nuttall, N. Am. Sylva i. 66 (1843), pro parte, non Turczaninow. — *S. pellita* Andersson in Svensk. Vetensk.-Akad. Handl. vi. 139 (Monog. Salic.) (1867), ex parte. — Ball in Trans. Ac. Sci. St. Louis, ix. 81 (1899), pro parte. — Howell, Fl. Northwest Am. 621 (1902). — Jones, Willow Fam. 25 (1908), pro parte. — Rydberg, Fl. Rocky Mts. 197 (1917), pro parte. — *S. chlorophylla*, var. *pellita* Andersson in De Candolle, Prodr. xvi.² 244 (1868), pro parte. — *S. sitchensis*, var. *angustifolia* Bebb in Watson, Bot. Cal. 87 (1879), quoad synon. — *S. Covillei* Eastwood in Zoë, V. 8 (October, 1900). — *S. pachnophora* Rydberg in Bull. Torr. Bot. Cl. xxxi. 403 (1904); Fl. Colo. 95 (1906); Fl. Rocky Mts. 197 (1917). — *S. sitchensis* Piper in Contr. U.S. Herb. xi. 216 (Fl. Wash.) (1906), quoad specim. Sandbergii & Leibergii No. 72, non Sanson. — *S. glaucops* Jones, Willow Fam. 16 (1908), pro parte, non Andersson. — *S. macrocarpa argentea* Jepson, Fl. Cal. 342 (1909), pro parte, non Bebb. — This species was first mentioned by Nuttall (1843) as *S. cuneata* which, however, is a mixture of *S. sitchensis* Sanson and *S. subcoerulea* so far as I can judge by his description. Nuttall says that the branches are "at first villous and downy, but at a later period brown, and sometimes quite blue, with a glaucous bloom." He, apparently, did not collect fruiting material of *S. subcoerulea* but only of *S. sitchensis*, but he distinguished narrow-leaved and broad-leaved varieties, the first probably being *S. subcoerulea*. He found his plants "growing in clumps near the rocky margin of the Oregon [Columbia] at its confluence with the Wahlamet" [Willamette], a region from which I have hitherto seen only *S. sitchensis*, but a Willow with pruinose twigs and leaves which are "always clad beneath with a whitish close tomentum, producing all the brilliant display of the finest velvet" can be nothing but *S. subcoerulea* which also in a rather young state has been mistaken for *S. sitchensis* by such an acute observer as C. V. Piper, who probably relied on Bebb's determination of Sandberg & Leiberg's No. 72 from Hangman Creek, Spokane County, Washington, May 24, 1893 (fr. im., W.) as *S. sitchensis* but the slightly pruinose branchlets and the aments at once point to *S. subcoerulea*. W. N. Saksdorf collected the same form near Spangle, Latah Creek, July 17, 1889 (No. 9306, st.; A.).

The pubescence of the species is indeed very similar to that of *S. sitchensis* but that species differs widely in every other respect, and never has pruinose twigs. From *S. pellita* with which *S. subcoerulea* had been mixed by Andersson, it differs by the characters given in the key. *S. pachnophora* Rydberg of which I have seen the type cannot, in my opinion, be distin-

¹ This name has already been used by Gandoger (Fl. Eur. xxi. 136 [1890] for a quasi subspecies of *S. nigricans* Smith, and cannot be applied to our species according to the Philadelphia Code. The International Rules however seem to allow the use of the later *S. subcoerulea* because Gandoger's *subcoerulea*, like most of his countless new names, represents nothing but a mere synonym. If *S. subcoerulea* is rejected the name *S. Covillei* Eastwood has to be taken up.

guished even as a variety. Rydberg indicates practically no other difference than "the sessile and naked aments" which are said to be peduncled and leafy in *S. subcoerulea*. Unfortunately the type of the latter has distinctly subsessile aments which hardly can be called pedunculate (as Piper says in his description) while the type of *pachnophora* has several almost sessile aments but also one with a distinct peduncle bearing a few small leaflets. Rydberg himself states in his description of the aments that they are subsessile.

As to *S. Covillei* Eastwood of which I have also seen the type it is rather strange that the author did not herself suspect its extremely near relationship or identity with *S. subcoerulea*. She believed that Coville & Funston's No. 1427 was identical with her species which, I think, was quite correct, and she herself refers to the fact that this specimen has been regarded by Piper as probably belonging to his *S. subcoerulea*. There may be a slight difference between the forms of the typical *subcoerulea* from Alberta to Oregon and northern New Mexico, and the Californian *S. Covillei* to which certain forms from Utah are extremely alike, but it will need a series of more copious and well-collected specimens than I have at present at hand to decide this question. Jepson obviously mistook *S. Covillei* because he puts this name in the synonymy of *S. macrocarpa argentea* without having seen the type. Miss Eastwood is quite right in saying that her new species "is so unlike that species that it would be a waste of time to enumerate the differences" because, as she states, *S. macrocarpa* (now *S. Geyeriana*) has peduncled aments subtented with leaves, and the flowers and the long pediceled fruits are entirely different from those of *S. Covillei*. In determining Willows one is only too often entirely misled at first, and even by a slow and careful examination it is not always possible to determine the proper identity of the plant.

I have seen specimens of what I am inclined to call typical *S. subcoerulea* (including *S. Covillei* sensu stricto) from eastern Oregon (Union County where the type was collected by W. C. Cusick, No. 1302, in the Powder River or Wallowa Mountains, in wet meadows near the head of Eagle Creek, in July-August, 1886, and in Harney County), northeastern Washington (Spokane County), Idaho (Idaho, Adams, Canyon, Blaine Counties; Lyall's syntype of *S. pellita* which came from "49 N. Lat." may have been collected in Boundary County), Montana (Glacier National Park, Flathead and Gallatin Counties), Wyoming (Yellowstone Park, Sheridan and Albany Counties), northeastern Nevada (Elko County), Utah (Salt Lake, Summit, Piute and San Juan Counties), Colorado (Routt, Larimer, Clear Creek, Lake, Gunnison, Ouray, Montrose, Dolores, Huernfano Counties), New Mexico (Rio Arriba, San Miguel County), and California (Fresno and Tulare Counties). A special form of *S. subcoerulea* may be represented by specimens collected by W. N. Suksdorf on Mt. Paddo (Adams) in Washington, July 11, August 28, 1886 (No. 9259, m., st.; A.; and in C. without No. [sheet 2644]). The slender branchlets are hardly pruinose and rather yellowish brown becoming purplish later. The leaves are linear-lanceolate,

measuring from 2:0.3 to 5:0.8 cm., bearing the same pubescence as the typical *subcoerulea*. The male aments are coetaneous, up to 2 cm. long and 1 cm. thick, with very short leafy peduncles. This form needs further observation; it somewhat resembles the forms with pubescent branchlets mentioned under *S. Drummondiana* but the twigs bear only a few scattered hairs at their tips.

8. *S. bella* Piper in Bull. Torr. Bot. Cl. xxvii. 399 (1900). — Rydberg, Fl. Rocky Mts. 196 (1917). — *S. glaucops glabrescens* Jones, Willow Fam. 16 (1908), quoad syn., non Andersson. — The type of this species came from Whitman County, Washington, 6 miles east of Pullman, near Garrison, where it was collected by L. F. Henderson in 1895 and 1896. I have seen the type (Herb. Pu.) and Piper's No. 2922 which is marked in Herb. G. "from type tree." *S. bella* is certainly a beautiful Willow but its relations to *S. subcoerulea* and *S. pellita* are not yet fully understood. I have pointed out the differences in the key. Piper states that the branches are very brittle, while in *S. subcoerulea* he does not note this fact. According to the information which Professor J. G. Jack has given me, it seems that all the species of this group have brittle jointed branches. Piper furthermore said in the note to his description that *S. bella* belongs to "the obscure *S. pellita* group," and that "its relationship is with *S. candida*." This species, however, belongs to a different section.

I add an enumeration of the specimens of *S. bella* which I have seen. Among them are some in which the lower (first) leaves are not distinguishable from those of *S. subcoerulea*, and bear the pubescence characteristic of that species, while the upper (later) leaves are distinctly covered with the less adpressed, not so lustrous silvery pubescence of *S. bella*. After all I am not sure if *S. bella* represents a variety of the other species. It is true that the pubescence of the lower surface of the leaves of *S. bella* is not unlike that of *S. pellita*, but in this species the lower leaves usually become more glabrous, glaucous and reticulate. To detect good characters in the male and female flowers of these very closely related species it would need an investigation of a series of well collected specimens accompanied, in order to be sure of their identity, by mature leaves of the same plant. Of *S. pellita* I have not yet seen male flowers, and perfectly ripe fruits of all the species are rare in herbaria because the specimens were mostly collected before the fruits were mature.

SPECIMENS EXAMINED: EASTERN WASHINGTON. Whitman County: near Garrison, August 18, October 14, 1895, April 4, m., May 5, f., 1896, L. F. Henderson (type material, Pu.); April 30, July 2, 1899, C. V. Piper (No. 2922 partim, f., st.; A., G.); same place, August 31, 1918, J. G. Jack (No. 1227, st.; A.; "bushes 10-12 feet high") 6 miles east of Pullman, April 30, July 2, 1901, C. V. Piper (No. 2922 partim, f., m., st.; A., W.); April 13, September, 1901, C. V. Piper (No. 3590, m., f., st.; A. G., W.); Spokane, October 1, 1900, C. V. Piper (No. 3517, st.; G.; forma quamvis incerta foliis inferioribus satis late obovatis, ad 6:2.5 cm. magnis, summis satis typicis.)

NORTHWESTERN IDAHO. Latah County: Jansville, July, 1898, C. V. Piper

(No. 2919, st.; a form with narrow leaves, much resembling *S. pellita*, but with twigs finely puberulous and stipules distinctly developed); Boville, thickets along stream, September 5, 1918, *J. G. Jack* (No. 1355, st.; A.; "8-10 feet high"; same as preceding). Shoshone County: Coeur d'Alene Mts., north fork of Coeur d'Alene River, 950 m., August 13, 1895, *J. B. Leiber* (No. 1533, st.; A., M., N., W.). Kootenai County: Coeur d'Alene, in sand along Fernau(?) Creek, April, 1914, August, 1913, *H. J. Rust* (No. 492, fr. partly teratological, st.; W.; "scrubby willow"); Fernau(?) Lake Shore, in sandy soil, same date and collector (No. 502, m., st.; W.; mixed with *S. Scouleriana* leaves). Bonner County: Priest Lake, August, 1901, *C. V. Piper* (No. 3742, st.; W.); west fork of Priest River, alt. 900 m., August 4, 1897, *J. B. Leiber* (No. 2841, st.; W.).

NORTHEASTERN MONTANA. Flat Head County: Swan Lake, alt. 1000 m., August 24, 1908, *M. E. Jones* (No. 9138, st.; M., W.). Glacier National Park, St. Mary, September 14, 1918, *J. G. Jack* (No. 1517, st.; A.; "5-6 feet high").

ALBERTA. Rocky Mountain District: Crow's Nest Pass, Oldman River, alt. 1300 m., August 14, 1897, *J. Macoun* (No. 7, st.; N.; folia inferiora ut in *S. subcoerulea* sericeo-pilosa); Banff, side of Cascade Creek by bridge, alt. 1550 m., June 6, August, 1899, *W. C. McCalla* (No. 2247, f., st.; N.; same as the preceding).

9. *S. Drummondiana* Barratt apud Hooker, Fl. Bor.-Am. II. 144 (1838). — Andersson in Öfv. Svensk. Vet.-Akad. Förh. xv. 123 (1858); in Svensk. Vet.-Akad. Handl. vi. 137 (Monog. Salic.) (1867); in De Candolle, Prodr. XVI.² 243 (1868). — Macoun, Cat. Can. Pl. 448 (1886). — Henry, Fl. S. Brit. Col. 99 (1915). — Rydberg, Fl. Rocky Mts. 196 (1917). — This is apparently a rare and rather critical species. The material before me is not sufficient to understand properly its taxonomic value, and to determine clearly its relationship to the preceding group of species and to the following one. The type was collected by Drummond in the "Rocky Mts.," probably in the Edson District of Alberta. I have before me a photograph and fragments of the type from the Kew Herbarium consisting of a piece with young female flowers, another with half-ripened fruits, and a third one with mature leaves. Besides this I saw a co-type in the Herbarium of the New York Botanic Garden. Both specimens have rather broad, obovate or obovate-elliptic leaves "below white with dense tomentum" as Hooker says, and glabrescent on the midrib. The pubescence is opaque as in *S. bella*, and not shining as in *S. subcoerulea*. The female aments and flowers are very much like those of *S. subcoerulea*, only the bracts of the flowers seem to be narrower and more acute, and the pedicels are mostly a little longer but their length seems to be rather variable in *S. subcoerulea* too, as also in other species of this group. The main difference are the broader leaves which in specimens like that of Rehder (see below) become rather elliptic-lanceolate or elliptic-ob lanceolate, a shape I have never noticed in *S. bella* but sometimes in *S. subcoerulea*, in which however the pubescence is thinner, adpressed, and silky, the veins being much more prominent. Besides the shape of the leaves there is the almost entire absence of the glaucous bloom of the branchlets which is so conspicuous in the two preceding species. If we have a better knowledge of the flowers and fruits they may afford additional good characters to separate these species, but at present I dare not to put much stress on the differences I have observed. I am not yet sure

whether the following specimens really all belong to *S. Drummondiana*, but I hope that we shall soon get more copious material from such frequently visited places as the vicinities of Banff and Laggan in Alberta. This species is mentioned by Macoun (1885) also from "on the beds of snow-slides, summit of the Selkirk Mountains, B.C." but I have not yet seen specimens from there. J. K. Henry (1915) does not cite a definite locality.

Hooker also mentions a form "*β. ovariis glabris*." He does not cite a type, and states that in *β* the pistils are quite glabrous, and that "in this var. the silky hairs of the scales are longer than in the usual state of the plant." Andersson said (1867) that he did not see a specimen belonging to this variety, neither have I.

SPECIMENS EXAMINED: ALBERTA. Edson District: Rocky Mountains, locality uncertain, *Drummond* (No. 672, f., st.; type in K.; No. "2. Hb. H. B. & T."¹ in N.) Jasper Park, Jasper, near Athabasca River, July 26, 1917, *J. M. Macoun* (No. 95,387, O., st.; A.). Rocky Mountain District: Lake Louise near Laggan, August 12, 1904, *A. Rehder* (fr.; A.; the specimen bears only one catkin with very poorly developed fruits, and the upper leaves are elliptic-lanceolate measuring up to 9: 2.8 cm., the lowermost are small and very narrow); vicinity of Banff, Cave Ave., July 4, 1891, *J. Macoun* (No. 31, st.; C.); bank of Cascade Creek by bridge, June 6, August 2, 1899, *B. C. McCalla* (No. 2247, f., st.; Cor.; "6 feet high"; leaves rather small obovate-lanceolate); at edge of snow-drift in a ravine on Mt. Aylmer, alt. 2300 m., August 4, 1899, *V. C. McCalla* (No. 2242^a, fr., 2247^a, f., m., female aments partly abnormal; Cor.; "3 feet high"; the fruiting aments measure up to 5.5: 1.5 cm.); National Park, Banff, July 1897, *C. Van Brunt* (st.; N.; forma incerta porro observanda).

I am not sure whether McCalla's specimens present the real *S. Drummondiana* or the same form as the following specimens which partly look like *S. Jepsonii*, and to which I wish to draw the special attention of collectors and students.

MONTANA. Flat Head County: Flat Head Lake and vicinity, MacDougal Peak, 2000 m., July 31, 1908, *Mrs. J. Clemens* (fr. im., M.; fructus crasse ovoideo-conici, pedicelli glandulam 2-plo superantes, 1.5 mm. longi, styli valde breves); same place and date, *M. E. Jones* (st.; M., W.); Old Marias Pass, circ. 2260 m., August 4, 1883, *C. S. Sargent* (st.; A.); Teton County: Midvale, streams, July 9, 1902, *L. M. Umbach* (No. 310, f., fr., M.). Park County: Emigrant Gulch, alt. 2250 m., August 23, 1897, *P. A. Rydberg* & *E. A. Bessey* (No. 3412, st.; N.; forma porro observanda).

BRITISH COLUMBIA. Kootenay District: north side of Wapta Lake, August 2, 1904, *J. Macoun* (No. 68,890, O., st.; G., N.).

ALBERTA. Rocky Mountain District: Lake Agnes, 2260 m., August 11, 1897, *C. S. Sargent* (st.; A.; "3-4 feet"); Laggan, July 11, 1911, *M. O. Malte* (No. 86,842, O., fr.; fructus satis longe pedicellati); Banff, east of Spray River, wet places, June 3, 1891, *J. Macoun* (No. 24,711, O.; st.; folia etiam superne satis sericea); Canmore, damp places, June 3, 1885, *J. Macoun* (25 [= 24,286, O.], st.; like the preceding); Crows Nest Pass, August 4, 1897, *J. Macoun* (No. 94,322, O., st.); same Pass, the

¹ In Bot. Gaz. LXVI. 322 (1918) I spoke of a specimen labeled No. "6. Hb. H. B. & T.," consisting of a fruiting catkin of *S. glauca acutifolia* (Hooker) Schn., and a sterile branchlet of the identity of which I then was not sure. This piece apparently belongs to *S. Drummondiana*.

Gap, August 6, 1897, *J. Macoun* (No. 94,323, O., st.). Calgary South District: Elbow River, Bragg's Creek, July 4, 1897, *J. Macoun* (No. 94,324, O., st.; "a small tree").

There is also a specimen before me collected by W. C. Cusick in 1886 (No. 1302^a, st.; W.) in wet alpine meadows apparently at the type locality of *S. subcoerulea*, which in the pubescence of the young twigs and of the upper surface of the leaves agrees more with some of the forms just mentioned than with typical *subcoerulea* but the branchlets are partly somewhat glaucescent.

10. *S. Jepsonii*,¹ spec. nov. — *S. sitchensis* var. *angustifolia* Bebb in Watson, Bot. Cal. II. 87 (1879). — Jepson, Fl. Cal. 342 (1909). — *S. pellita* Bebb in Bot. Gaz. XVI. 105 (1891), non Andersson. — Ball in Trans. Acad. Sci. St. Louis, IX. 81 (1899), pro parte. — *S. sitchensis* Hall, Yosemite Fl. 67 (1912), non Sanson. — Frutex ut videtur erectus, habitu et altitudine mihi ignota; ramuli novelli laxi vel dense breviter villosulo-tomentosi, hornotini plusminusve glabrescentes et ut annotini glabri (vel tantum partim parce tomentelli) castanei vel atro-purpurascens, plerique nitiduli, vetustiores cinerascens; gemmae perfecte evolutae nondum visae, novellae ut ramuli pilosae; folia matura satis chartacea, firma, anguste oblanceolata, basi cuneata, apice obtusa ad acuta, minimis infimis exceptis 2:0.6 ad 6.5:1.2 cm. vel latiora obtusiora ad 5:1.3 cm., surculorum ad 12.5:1.5 cm. (Jepson no. 386) vel anguste elliptica vel etiam ovato-lanceolata ad 9:1.2 vel 10:2.5 cm. magna, margine integerrima, interdum leviter undulata, saepe subrevoluta, superne initio plusminusve sparse (vel in surculis dense) breviter sericeo-villosula, dein costa tomentella excepta glabrescentia, intense sed ut videtur satis obscure viridia, costa nervisque lateralibus subplanis, epidermide estomatifera, subtus tomento sericeo denso adpresso micante vel subopaco ut in *S. sitchensi* (vel in *S. subcoerulea*) vestita, costa elevata flava etiam tomentella (rarius fere glabrescente), nervis lateralibus utrinque circ. 10-16 fere occultis vel paullo prominulis; petioli plusminusve tomentosi, 2-6, etiam in surculis vix ultra 7-8 mm. longi; stipulae nullae vel pleraeque parvae, semiovato-lanceolatae, integrae vel glanduloso-denticulatae, ut folia pilosae, ad 3 mm. longae, vel in surculis (specim. Jackii) semicordatae, ad 11 mm. longae et 5 mm. latae. Amenta subpraecocia vel coetanea, cylindrica; mascula subsessilia vel pedunculo ad 3 mm. longo foliola minima 2-4 dense normaliter pilosa gerente suffulta, 1-2:1 cm. magna; bractae oblongo-obovatae, satis dilute brunneae vel apice subfuscae, dense sericeae pilis bracteam vix aequantibus; stamina 2, filamentis liberis vel in parte inferiore amenti saepe basi vel ad medium coalitis glabris bracteam demum ad 2-2 1/4-plo superantibus, antheris ut videtur semper aureis ellipsoideis circiter 1 mm. longis thecis inaequalibus; glandula 1, ventralis, ovoideo-conica, truncata, bractea 1/2 vel 1/3 brevior; feminea sub anthesi 1.5-2.5:0.6

¹ It gives me great pleasure to dedicate this species to Professor W. L. Jepson without whose rich collections of Willows I should not have been able to elucidate several of the interesting but little understood Californian species.

cm., fructifera 2-4:1-1.3 cm. pedunculo foliolato 0.8-2 cm. longo excluso magna; bracteae ut in floribus masculis; ovaria sub anthesi ellipsoidea vel oblongo-ovoidea, dense breviter sericeo-tomentosa, pedicello brevi vix ad 1 mm. longo glandulam vix superante; styli breves, circiter 0.75-1 mm. longi, integri (vel in no. 12138 *Helleri* subbifidi), stigmatibus oblongis bifidis vix vel 1/2-plo longiores; glandula 1 ut in flore masculo; fructus maturi e basi ovoideo vel crasse ellipsoideo conici vel subrostrati, 4.5-5.5(-6) mm. longi pedicello ad 1.25 mm. (in no. 12318 ad 2 mm.) longo glandulam ad fere 2-plo superante excluso.

TYPE LOCALITY: high mountain near Donner Pass, Placer County, California.

SPECIMENS EXAMINED: CALIFORNIA. Placer County: high mountain near Donner Pass. 1865, *J. Torrey* (No. 489, fr. in.; type; G.); by brook between Donner Lake and Summit, July 14, 1900, *W. R. Dudley* (No. 5063, fr.; st.; an *typica*?); Lake shore above McKinney's June 24, 1900, *W. R. Dudley* (No. 5527, fr.; St.; mixed with sterile *S. Lemmonii* Bebb; Placer-Eldorado County line, lower valley of McKinney's Creek, June 24, 1900, *W. R. Dudley* (No. 5534, fr.; St.). Eldorado County: Lake Tahoe Region, Gilmore Lake, alt. 2700 m., July 29, 1911, *L. R. Abrams* (No. 4854, fr. im.; G.); Susie Lake, 1909, *A. Eastwood* (No. 1262, f.; Cal.); Tahoe Region, creek bank between Heather and Suzy Lakes, 2600 m., July 18, 1913, *F. J. Smiley* (No. 144, fr.; G.); moist shores of Echo Lake, in granite, alt. circ. 2500 m., August 15, 1915, *A. A. Heller* (Nos. 12137, 12138, fr.; A., G., M., St.; fructibus pedicellis ad fere 2 mm. longis bracteam subaequilongis suffultis, amentis pedunculo ad 1.5 cm. longo excluso ad 3.5; 1.3 cm. magnis); Glen Alpine Region, Trail to Lake Lucille, July 21 to August 15, 1906, *A. Eastwood* (No. 1038, f.; Cal.); near Glen Alpine Springs, June 1900, *W. R. Dudley* (No. 5662, fr.; St.); below Lake Lucille, June 1900, *W. R. Dudley* (No. 5653, fr.; St.); Lily Lake, August 2, 1906, *A. Eastwood* (No. 1202, m., Cal.); Heather Lake, same date and collector (No. 1212, m., Cal.); Tuolumne County: Sonora Pass Road, 2900 m., August 27, 1915, *A. L. Grant* (No. 386, st.; Jeps.; foliis anguste lanceolatis ad 11:3 cm. longis). Mariposa County: Yosemite National Park, Bear Valley, 1872, *H. N. Bolander* (f.; G.); Lake Tenaja, August 18, 1917, *A. Eastwood* (No. 447, st.; Cal.; resembles Jack's specimen enumerated below); Yosemite Valley, 1300-1500 m., July 10, 1911, *L. R. Abrams* (No. 4672, fr. im.; G.); by brook beside Nevada Fall and Cloud's Rest Trail, June 11, 1894, *W. R. Dudley* (f.; St.); Lake Merced, Merced River, 2400 m., July 10, 1909, *W. L. Jepson* (Nos. 3200, 3206, f.; Jeps.; forma porro observanda); Stubblefield Canyon, 2500 m., July 28, 1911, *W. L. Jepson* (No. 4531, f.; Jeps.); Illilouette Canyon, 2100 m., June 20, 1912, *E. B. Babcock* (No. 1057, f.; N.); Chihuahu Trail, August 1, 1898, *J. W. Congdon* (m., fr.; G.). Madera County: Shuteye Mt., creek bank, 2600 m., July 19, 1914, *F. J. Smiley* (No. 563, fr. im.; G.); same mountain, 2200 m., August 8, 1907, *J. G. Jack* (st.; A.; shoots with long narrowly elliptic acute leaves up to 9.5:2.3 cm., and with distinct semicordate lanceolate stipules somewhat surpassing in length the petioles. In the shape and nervation of the leaves it recalls *S. Coulteri* but the pubescence is typical).

This puzzling Willow was described in 1879 by Bebb as *S. sitchensis* var. *angustifolia*. The type was collected by Torrey on a "high mountain near Donner Pass" in 1865. This is Torrey's No. 489 in the Gray Herbarium and in the Herbarium of the New York Botanic Garden. Bebb quoted as a synonym *S. chlorophylla* var. *pellita* Andersson stating that it "accords essentially (excepting the pointed leaves) with the description of *S. chlorophylla* var. *pellita* Anders., though when compared with Dr. Lyall's speci-

mens from the Rocky Mountains, cited by the author, the discrepancy is greater." Later, in 1891, Bebb declared that "it was a mistake to arrange the little willow collected on a high mountain near Donner Pass by Dr. Torrey, as a variety of *S. sitchensis*," and that it belonged to *S. pellita*. Ball (1899) expressed the same opinion, in both cases *S. pellita* meaning *S. subcoerulea* to which as I have already explained on p. 82 Lyall's specimen belongs. I have before me Torrey's No. 489, and all the specimens enumerated below which apparently represent the same form. Almost all of them are female, but fortunately Eastwood's Nos. 1202 and 1212 are males and on a specimen of Congdon's I have also found a male ament. These specimens show that the flowers always have two distinct stamens, the filaments of which are mostly free, and the anthers obviously golden-yellow. This fact proves that var. *angustifolia* cannot be united with *S. sitchensis* nor with *S. Coulteri* notwithstanding the extreme similarity of the pubescence of the leaves with that of *S. sitchensis*. On the other hand it is certainly not identical with *S. subcoerulea* but may after all be best placed in the same section.

A. A. Heller's specimen from Butte County, west branch of the North Fork of the Feather River near Stirling, circ. 1000 m., June 7, 1913 (No. 10832, fr.; A., G., M., N.) is so much alike typical *S. sitchensis* which otherwise seems to be absent from California (unless some forms referred by me to *S. Coulteri* prove to belong to it) that I cannot decide whether it ought to be taken for *S. Jepsonii* as long as male flowers from the same locality are unknown. There is a specimen from Nevada, Churchill County, Carson Sink Region, alt. 1400 m., July 15, 1908, *P. B. Kennedy* (No. 1777, fr.; M., Reno), distributed as *S. Scouleriana*, which in the shape of the fruits and stigmas, somewhat longer than the very short style, points indeed to this species but otherwise can hardly be distinguished from *S. Jepsonii*. The leaves partly show an obscure glandular dentation. This Willow comes from a region which is not yet sufficiently explored.

In 1909 Jepson (Fl. Cal. 342) described a *S. sitchensis* f. *Ralphiana* from Sequoia National Park, Giant Forest, Marble Fork of the Kaweah River, Tulare County, 2300 m., June 24, July 2, 1900, *W. L. Jepson* (No. 690 f.; Jeps.). The type is before me, and it shows that the character of the pubescence is rather intermediate between that of *S. sitchensis* and *S. Coulteri*, and in all the flowers which I have examined I have found a distinct dorsal gland. The leaves measure up to 9.5:2.2 cm., and the aments up to 6:1.4 cm. This form apparently is closely related to *S. Jepsonii* or comes nearer *S. Coulteri*. It needs further study of young female and male material. This also applies to *W. R. Dudley's* No. 2837 from Bear Creek, Grant National Park, July 29, 1900 (fr.; St.).

b. THE SPECIES OF SECTION SITCHENSES

In 1891, Bebb (in Bot. Gaz. xvi. 105) proposed the sect. *Sitchenses* for *S. sitchensis* Sanson because this Willow differs from all the other American species (except *S. Uva-ursi* Pursh) in having only one stamen. In 1903

von Seemen (*Salices Japonicae* 21) referred several Japanese species which have only one stamen (at least in part of the flowers) to a new section *Sieboldianae*, and he also mentioned (p. 13) *S. sitchensis*, *S. Coulteri*, and *S. wigututiana* as belonging to his group *Submonandrae*. Neither he nor I in 1904 when I published the *Salices* of my *Ill. Handb. Laubh.* i. 69, were aware of the fact that Bebb had already proposed a sect. *Sitchenses*. In 1916 (in Sargent, *Pl. Wils.* iii. 161) I dealt with the sect. *Sieboldianae*, but I do not yet know if the Japanese species really ought to be united with *S. sitchensis* in the same group. *S. Uva-ursi*, of which *S. wigututiana* is only a synonym, cannot be included in this section, and its relationship is still doubtful as I have already pointed out (in *Bot. Gaz.* XLVII. 50 [1919]). To which of the other American sections the *Sitchenses* approach most closely is still a question I cannot definitely answer at present.

CLAVIS SPECIERUM

Bracteae florum plus minusve distincte, praesertim ad apicem, fuscescentes; antherae (an semper?) violaceae; folia pleraque plusminusve oblanceolata, obovato-lanceolata vel obovato-elliptica, subtus tomento denso brevi plusminusve adpresso argenteo micante oblecta, etiam adulta submembranacea 1. *S. sitchensis*.
Bracteae florum satis flavescens vel ad apicem flavo-brunneae, sed vix fuscescentes; antherae aureae; folia normalia obovato-oblonga ad elliptico-oblonga, subtus tomento denso albescente subsericeo-villoso magis opaco quam argenteo-micante oblecta adulta chartacea; satis crassa 2. *S. Coulteri*.

1. *S. sitchensis* Sanson apud Bongard in *Mém. Acad. Imp. Sci. St.-Petersb.* sér. 6. ii. 162 (1833). — Hooker, *Fl. Bor.-Am.* ii. 153, in nota apud no. 41 (1839). — Andersson in *Öfv. Svensk. Vet.-Akad. Förh.* xv. 126 (1858); in *Proc. Am. Acad.* iv. 66 (*Sal. Bor. Am.* 21) (1858); in Walpers, *Ann. Bot.* v. 752 (1858); in *Svensk. Vet.-Akad. Handl.* vi. 106, t. 6, fig. 59 b, d, g (*Monog. Salic.*) (1867), excl. planta masc., et **S. ajanensis*; in De Candolle, *Prodr.* xvi.² 233 (1868), pro parte maxima et excl. var. γ . — Bebb in Watson, *Bot. Cal.* ii. 87 (1879), pro parte minima; in *Bot. Gaz.* vii. 25 (1852); xvi. 105 (1891), excl. *S. Coulteri*. — Sargent, *Silva N. Am.* ix. 149, t. 486 (1896) excl. syn. *S. Coulteri*; *Man. Trees N. Am.* 187, fig. 159 (1905), excl. specim. cal. — Coville in *Proc. Wash. Acad. Sci.* ii. 278. (1900); l. c. iii. 307, t. 33 (1901). — Howell, *Fl. Northwest Am.* 620 (1902), ex parte. — Piper in *Contr. U.S. Nat. Herb.* xi. 216 (*Fl. Wash.*) (1906). — Britton & Shafer, *N. Am. Trees* 202, fig. 165 (1908), excl. specim. cal. — Ball in Piper & Beattie, *Fl. Northwest Coast*, 116 (1915). — Henry, *Fl. S. Brit. Col.* 98 (1915). — Rydberg, *Fl. Rocky Mts.* 196 (1917). — *S. Scouleriana* Barrat apud Hooker, *Fl. Bor.-Am.* ii. 145 (1839), pro parte, quoad folia, fide Andersson. — *S. cuneata* Nuttall, *N. Am. Sylva*, 66 (1843), pro parte, non Turczaninow. — *S. sitchensis congesta* Andersson in *Svensk. Vet.-Akad. Handl.* vi. 107 (1867); in De Candolle, *Prodr.* xvi.² 233 (1868).

The type of this peculiar and handsome species came from Sitka where it, as stated by Coville, was collected along Indian River by "Henry Martens, the botanist of Lütke's Expedition, in an excursion from Sitka to the

summit of the neighbouring Mount Verstovia, in the year 1827." As Coville says, it "is a characteristic plant of the Sitkan floral district extending from the southernmost limit of Alaska northward and westward along the coast to Cook Inlet and the eastern end of Kadiak Island." South of Sitka it is a "very common plant at the coast" J. K. (Henry) of British Columbia, from where I have also seen specimens from the Yale and Kootenay Districts. In the United States it has been found in western Washington and western Oregon, but also in southeastern Oregon (Blue Mountains) and eastern Washington (Wallowa and Steins Mts.), in Idaho (Elk River, Clear County), and Montana (Belton, Flathead County). The species is readily distinguished by the satiny pubescence of the lower surface of its mostly more or less obovate leaves. Sometimes specimens of a pubescent form of *S. Scouleriana* with which I shall deal in a later article, have been taken for *S. sitchensis*, but the villose pubescence of these forms is very different as also usually is the shape (more elliptic) of their leaves.

Andersson (1867) proposed two varieties of *S. sitchensis*: "— *congesta*; foliis angustioribus; amentis ob capsulas crassissimas et breves subsessiles valde densifloris," and "— *denudata*; foliis subtus demum glabratis tenuibus." The types of both were collected by Lyall along the lower Frazer River. There is before me a specimen of Lyall's from this region collected in 1859 (m., f.; N.). The sheet on which it is mounted bears a label "*Salix sitchensis* Bong. *congesta* Ands." in Andersson's own handwriting. On the label is written by another hand "Lower Fraser River, C. B. Wood, 1839," and it is referred to a piece with rather old female aments. I do not know of a collector C. B. Wood. All the pieces, in my opinion, represent typical *S. sitchensis*. Another specimen of Lyall's, lower Frazer River, Sumass, swamps, April 20, 1857, does not agree with either variety. Whether var. *denudata* really belongs to *S. sitchensis* remains doubtful, especially as Andersson (in 1868) states that the leaves of it are "iis *S. silesiacae* v. *S. cinereae* haud absimilibus." There are specimens collected by Coville & Kearney (No. 442) and B. E. Fernow, on June 5, 1899, at Fort Wrangell, southeastern Alaska, which Coville regards (Herb. W.) as "probably a denudate" *S. sitchensis*. Fernow's plant in Herb. Cor. is mixed with *S. Barclayi*, and without mature leaves, flowers or fruits it is impossible to decide whether it is a hybrid or a variety of *S. sitchensis*. Andersson's third var. *ajanensis* (1868), which he (1867) first published as a quasi subspecies as *S. sitchensis* **S. ajanensis*, came from northeastern Asia, and is unknown to me.

2. *S. Coulteri* Andersson in Öfv. Svensk. Vet.-Akad. Förh. xv. 19 (1858); in De Candolle, Prodr. xvi.² 264 (1868). — Bebb in Watson, Bot. Cal. ii. 90 (1879). — Behr, Fl. Vic. San Francisco, 217 (1888). — *S. sitchensis* Bebb in Bot. Gaz. vii. 25 (1882), pro parte, non Sanson; l. c. xvi. 105 (1891), pro parte. — Jepson, Fl. W. Middle Cal. ed. 2. 119 (1911). — *S. sitchensis* f. *Coulteri* Jepson, Fl. Cal. 342 (1909). — In 1882, Bebb discussed the specific value of this species which at this time was only known from Coulter's

type specimens collected probably near Monterey, and Bolander's poor and uncertain specimen from Marin County. Therefore, Bebb, at this time and in 1891, regarded *S. Coulteri* as representing "nothing more than an abnormal development of *S. sitchensis*." Judging by the material enumerated below it seems to me that *S. Coulteri*, although certainly closely related to *S. sitchensis*, nevertheless presents some peculiar characters of its own which lead me to keep it as a species until more abundant material convinces me that no rigid line can be drawn between the two species. The difference in the pubescence of their leaves is much the same as that between *S. subcoerulea* and *S. bella* or *S. pellita*. In *S. Coulteri* the rather rigid old leaves bear a much more woolly and dull felt-like tomentum on their lower surfaces, which often is rather yellowish on the young leaves at the top of the branchlets which are clothed with the same kind of pubescence. The lowermost (first) leaves and those of the peduncles show a more or less shining covering of long silky adpressed hairs. The aments are more slender than those of *S. sitchensis*, the yellowish or light brown bracts are more lustrous silky, and the anthers are golden yellow. The fruiting aments sometimes measure up to 13:1.3 cm., and the well-matured fruits are usually from 0.5 to 1 mm. shorter than those of *S. sitchensis*. I refer the following specimens to *S. Coulteri*.

CALIFORNIA. Santa Barbara County: May, 1879, *E. Cooper* (f.; G.); without date, *J. C. Lemmon* (st.; G.). Monterey County: locality and date uncertain, *Coulter* (No. 655, m.; type in K., cotype in G.); Santa Lucia Mountains, near seashore, 1880, *G. R. Vasey* (st.; A.); Pacific Valley, near Mansfield's, May 1-12, 1897, *A. Eastwood* (f.; fr.; G.; ament's ad 9 cm. longis flexuosis); Willow Creek, same date and collector (m., fr.; A.; amentis fructiferis ad 12:1.2 cm. magnis); Santa Lucia Mountains, February, 1898, *R. A. Plaskett* (No. 29, m., st.; G.); March, 1898, same collector (No. 51, f., st.; G.); Lucia, June 14-20, 1901, *W. L. Jepson* (No. 1621, fr.; Jeps.; folia ad 13.5:7 cm. magna, obovali-elliptica); Monterey, May, 1875, *C. L. Andersson* (st.; A., M.); Point Sur, July, 1888, *T. S. Brandegee* (st.; A.). Santa Cruz County: Santa Cruz, 1875 and 1877, *C. L. Andersson* (fr., st.; A., G., M.; some of the specimens only partly). Santa Clara County: Wrights, August 3, 1895, *A. Eastwood* (No. 41, f., m.; G.); June, 1903, *A. D. E. Elmer* (No. 4687, fr.; M.); Black Mountain, April, 1903, *A. D. E. Elmer* (No. 4684, m., f.; M.); Stevens Creek Road, March 5, 1905, *W. R. Dudley* (f.; G.). San Mateo County: King's Mountain, along streams near the summit of the range, March 18, May 1, 1902, *C. F. Baker* (No. 390, m. f., fr. im.; G., M.); same mountain, March and September, 1902, *L. R. Abrams* (No. 2272, m., f., st.; M.); same place, March, 1902, *A. D. E. Elmer* (No. 4115, m., f.; M.); Portola, April, 1903, same collector (No. 4917, fr.; M.); Bear Gulch, 230 m., March 7, 1904, *W. R. Dudley* (No. 69, f., 70, m.; A.). Marin County: Lagunitas, March 28, 1915, *A. Eastwood* (No. 3992, m., f.; A.). Sonoma County: Sonoma Creek, foot of Mt. Hood, March 12, June 26, 1902, *A. A. Heller* (No. 5044, m., f., st.; A., G., M., St.; forma paullo ad *S. sitchensis* vergens, porro observanda); Fort Ross, April 23, 1903, *A. A. Heller* (No. 6602, fr.; M., G.). Humboldt County: vicinity of Eureka, March 6, 1904, November 5, 1905, *J. P. Tracy* (No. 2398, f., st.; G.).

The specimens collected by Bolander near San Francisco (No. 2451, m.; G.) represent an uncertain form with pilose filaments.

The form described by Jepson (Fl. Calif. 342 [1909]) as *S. sitchensis* f.

parvifolia, from Mendocino County, Melbourne to Comptche, June-July 1903, *W. L. Jepson* (No. 2229, st.; Jeps.) seems to be a small-leaved form of *S. Coulteri* judging by the pubescence of its branchlets and leaves which measure up to 3.8:0.9 cm. Therefore I propose for it the name *S. Coulteri* f. *parvifolia*, nov. comb.

c. SECTION BREWERIANAE

As I shall presently explain, *S. Breweri* Bebb represents such an unique type among American Willows that it seems best to refer it to a separate section in which I also place *S. delnortensis* described below which apparently is most closely related to *S. Breweri*. Therefore, I propose sect. *Brewerianae*, sect. nov. — Frutices ut videtur satis parvi ramis divaricatis probabiliter basi tenacibus tenuioribus subangulatis. Folia matura crasse chartacea, lanceolata vel obovata, subtus densissime albescenti-tomentosa, distincte elevato-reticulata. Amenta praecocia vel coetanea, sessilia vel subsessilia, anguste cylindrica, densiflora, saepe flexuosa; flores masculi diandri, filamentis liberis glabris vel basi parce pilosis, glandula 1 ventrali anguste conica; feminei fructusque sessiles, dense sericeo-villoso-tomentosi; styli distincti, circ. 1 mm. longi, saepe plusminusve bifidi, stigmatibus brevissimis oblongis bifidis circ. $2\frac{1}{2}$ -plo longiores; glandula 1 ut in flor. masc.; fructus ovoideo-conici, 4.5-5 mm. longi, ut ovaria pilosi. — For further remarks see under *S. Breweri*.

CLAVIS SPECIERUM

Folia anguste lanceolata; glandula florum satis longa et fere filiformis 4-5-plo longior quam crassa; antherae ut videtur semper aureae 1. *S. Breweri*.
Folia obovata; glandula brevior et subcrassior $2\frac{1}{2}$ -3-plo longior quam crassa; antherae (saltem initio) violaceae 2. *S. delnortensis*.

1. *S. Breweri* Bebb in Watson, Bot. Cal. II. 89 (1879); in Bot. Gaz. XVI. 106 (1891). — Jepson, Fl. Cal. 343 (1909). — When Bebb described this species from specimens collected by W. H. Brewer "on San Carlos Mountain in a dry ravine" he spoke of it as of a "genuine American representative of the *Viminales*." Later (1891) he said: "Beyond all comparison this is the rarest and most obscure of the North American willows." Having seen probably all available herbarium material I can speak as follows about this peculiar species. The most complete description which has been given of it is by Jepson, as Bebb did not know the male plant. Its normal upper leaves are oblong or narrowly lanceolate to almost linear-lanceolate, measuring from 4:0.5-1.2 to 6:0.8-1 cm.; they are rather dull green and never quite glabrous above, and densely villose-tomentose beneath where the reticulation is quite distinct. The petioles are very short, hardly up to 2 mm. long, and the stipules are wanting or ovate-lanceolate, and 1-3 mm. in length. The almost sessile narrowly cylindric aments appear before (or sometimes with) the leaves. The male aments measure up to 1.5-2:0.5-0.6 cm., while the fruiting aments attain 3.5:1 cm. Both have yellowish

scales which sometimes become reddish brown at the obtuse apex. They are densely clothed with long silky hairs. There are 2 stamens with free filaments which usually seem to be glabrous but occasionally bear a few hairs at the very base; the gland is very long and almost linear, resembling indeed that of *S. viminalis* L. Glands and bracts are alike in the two sexes. The ovaries are sessile, ovoid-ellipsoid, and bear a distinct filiform style about 1 mm. in length which usually is bifid at apex and has small, narrow, more or less bifid stigmas. The shape of the stigmas is rather different from that of the *S. viminalis* stigmas which are narrowly linear and much longer. I am not convinced that *S. Breweri* is at all closely related to the *Viminalis*. The species of this European-Asiatic section have dark fuscous bracts, stouter male aments and longer petioles, and their leaves usually have a very different kind of pubescence of silky shining hairs. Although I am at present unable to make a definite statement as to the real relationship of *S. Breweri*, it seems best to regard it as the representative of a new section.

This Willow is an inhabitant of the arid region of the Inner Coast Range, and I have seen the following specimens. In the northwest corner of California an apparently very closely allied form is found which I describe below as *S. delnortensis*.

SPECIMENS EXAMINED: CALIFORNIA. San Benito County: San Carlos¹ Mountain, in a ravine, 1150 m., July 23, 18(60-62), *W. H. Brewer* (No. 788, fr.; G.; co-type); San Carlos Range, 1300 m., May 12, 1907, *W. L. Jepson* (No. 2957, f., m.; Jeps.); in the semiarid section of the inner South Coast Range, head waters of San Benito River, alt., 950 m., May 27, 1915, *H. M. Hall* (No. 9937, f., m., fr.; A.; "clumps 1 m. high"); Hernandez, April 11, 1903, *L. M. Lathrop* (m.; St.; amentis ad 3.5:0.6 cm. longis); near Hernandez, May 18, 1893, *A. Eastwood* (fr.; Cal.); Cantua Creek, near New Idria, May 19, 1893, *A. Eastwood* (m., f., St.); Clear Creek, May 31, 1899, *W. R. Dudley* (fr.; St.); above New Idria Falls, same date and collector (m., f., fr.; St.); Trail to Hepsadan Peak, June 2, 1899, *W. R. Dudley* (fr.; St.). Santa Clara County: San Antonio Valley, May, 1903, *A. D. E. Elmer* (No. 4648, f.; M., St.). Napa County: Mt. St. Helena, *Mrs. Brandegee* (No. 1299, f.; C.; mixed with fruiting *S. lasiolepis*). Lake County: 3 mi. northwest of Glenbrook, Sweetwater Valley, May 17, 1902, *J. A. Gunn* (m., f.; St.; floribus juvenilibus porro observandis, femineis abnormalibus fere semper 2-3 connatis); Middleton Grade, just beyond Mt. St. Helena, on the serpentine, May 5, 1893, *W. L. Jepson* (No. 278, m.; Jeps.); Mt. Hannah, *A. Eastwood* (m.; Cal.; filamentis ex parte basi paullo coalitis, forma incerta). Colusa County: Epperson, *Mrs. Brandegee* (No. 18½, f.; C.).

2. *S. delnortensis*, spec. nov. — Frutex ut videtur habitu *S. Breweri*, altitudine mihi ignota; ramuli hornotini dense breviter griseo-tomentosi, etiam annotini plusminusve angulati sordide purpurascentes, satis tomentelli, vetustiores plusminusve glabrescentes; gemmae perfecte evolutae nondum visae, ut rami tomentosae et coloratae; folia tantum juvenilia et semimatura satis chartacea visa, obovato-oblonga, obovata vel late obovata, basi cuneata, apice obtusa ad rotundata, subito brevissime apiculata, ad 2.5:1-1.6 cm. magna, integerrima, superne initio dense plusminusve ad-

¹ This is in my opinion identical with Santa Carlos Peak, southeast of Idria. I had an opportunity to discuss this Willow with Prof. L. R. Abrams, who has kindly given valuable information about the vegetation of the Inner Coast Range.

presse villosulo-tomentosa, demum ut videtur paullo glabrescentia, sordide viridescencia, costa nervisque paullo impressis, subtus dense albescenti-vel flavescenti-tomentosa, costa nervisque lateralibus utrinque 6-9 elevatis tomentosis et etiam (matura probabiliter distinctius) reticulata; petioli vix ultra 2 mm. longi, dense tomentosi; stipulae nullae vel minimae punctiformes. Amenta coetanea (an semper?), pedunculis brevibus minime vel distinctius foliolatis suffulta; mascula ad 2.5:0.7 cm. magna, pedunculo ad 5 mm. longo excluso; bractee oblongae, obtusae, brunnescentes (an in vivo roseae?), utrinque satis dense sericeae (pilis plerisque bractea brevioribus); stamina 2, filamentis liberis glabris bracteam dein ad fere 2-plo superantibus, antheris minimis crasse ellipsoideis vix ultra 0.6 mm. longis ut videtur violaceis; glandula 1, ventralis, anguste conica, truncata, bractea 2-plo brevior; feminea subpraecocia, sub anthesi ad 2.5:0.6 cm., fructifera ad 5:1 cm. magna pedunculo 2-8 mm. longo excluso; bractee ut in flore masculino vel magis obovatae; ovaria ovoidea, dense breviter villosulo-tomentosa, sessilia; styli circiter 1 mm. longi, integri vel subbifidi, stigmatibus brevibus bifidis stylo circiter $2\frac{1}{2}$ -plo brevioribus; glandula 1 ut in flore masculino; fructus ellipsoideo-conici, circ. 5.5 mm. longi, ut ovaria pilosi.

TYPE LOCALITY: Gasquets, Del Norte County, California.

SPECIMENS EXAMINED: CALIFORNIA. Del Norte County: Waldo-Crescent City Road, Gasquets, April 23, 1907, *A. Eastwood* (No. 52, fr. submat.; Cal.; type!); Rock Creek, April 29, 1907, *A. Eastwood* (No. 177, f.; Cal.); Smith River near Adams, May 4, 1907, *A. Eastwood* (No. 233, m. paratype; Cal.).

At first, I was inclined to regard this plant as only a broad-leaved variety of *S. Breweri*, but the shape of the gland in the male and female flowers is different in the two. In *S. Breweri* the gland is narrower and often almost filiform, especially in the female flowers in which it is half the length of the young ovary. In *S. delnortensis* the gland is also narrow but shorter and never filiform. The anthers seem to be always yellow in *S. Breweri* and violet in the new species, but, of course, a careful observation is needed of more copious material with mature leaves and a study of the plants in the field to fix the specific value of *S. delnortensis*. It apparently also grows in a semiarid region; and Miss Eastwood collected another peculiar willow near Gasquets, which too seems to represent a new species the relation of which, however, is with *S. Scouleriana* notwithstanding a certain similarity to *S. delnortensis* in its external appearance. I shall deal with it when I speak of *S. Scouleriana* in a later note.

THE BONIN ISLANDS AND THEIR LIGNEOUS VEGETATION

E. H. WILSON

SOME 520 miles almost due south of Tokyo, Japan, is a group of small islands known to the western world as the Bonin Islands and to the Japanese as Ogasawara-shima. These islands are governed by the Tokyo prefect, and communication is maintained by a monthly steamer plying from Yokohama. They lie between the parallels of Lat. $27^{\circ} 5$ m. and $26^{\circ} 30$ m. N.,

with the chief port, Omura, — Port Lloyd of our maps — in Lat. $27^{\circ} 4.35$ m. and Long. $142^{\circ} 11.3$ m. E., and are divided into three groups, the central being the largest and most important. The northern, the Parry group of our maps, is called Mukō-jima (Son-in-law Islands) by the Japanese, and consists of four tiny islands having a total area of 1096 acres and a population of 40. The central group, Chichi-jima (Father Islands) of the Japanese, consists of eight islands of a total area of 9472 acres and a population of 2230. Five of these islands are uninhabited. The three largest on our maps are called Peel, Buckland, and Stapleton Islands. The first named is the Chichi-jima proper of the Japanese; it is the principal one of the group being 5932 acres in extent with a population of 2140, and boasts the only safe anchorage in the Bonin Islands. The southern group, known as Haha-jima (Mother Islands), the Bailey or Coffin group of the western maps, consists of nine islands having a total area of 6219 acres and a population of 2030. Haha-jima proper (the Hillsboro Island of our maps) is itself 5121 acres in extent and has 2000 persons living on it. Five of the others are uninhabited.

The islands are steep and hilly and six of them are merely bare rocks less than 100 ft. high. The highest point is Chibusa-yama (Nipple Mt.) on Haha-jima which is 1527 ft. above sea-level. The highest point on Chichi-jima is Chuo-yama, 1060 ft. high and on Mukō-jima, Oyama only 295 ft. above the sea. The coast line of all is steep, and is much indented, and the tide-rips between the islands are very dangerous. Storms accompanied by high winds are frequent. Except at the port of Omura (Port Lloyd), embarking and disembarking is far from easy even in calm weather and the landing of cargo can only be done at such times.

The history of the Bonin Islands, little as it is, is of more than ordinary interest. Their very ownership was not definitely settled until November, 1875, when they passed into the possession of Japan. From Japanese records it appears that these islands were known to Japan in A.D. 1593 if not before, when they were held as a fief by the Daimio Ogasawara Sadayori and communication was maintained with them up to 1624. According to Kaempfer (*Hist. Jap.* i. 60, [1729]) about the year 1675 the "Japanese accidentally discovered a very large island, one of their barks having been forced there in a storm from the island Hachijo, from which they computed it to be 300 miles distant toward the east. They met with no inhabitants, but found it to be a very pleasant and fruitful country, well supplied with fresh water and furnished with plenty of plants and trees, particularly the Arrack tree, which, however, might give room to conjecture that the island lay rather to the south of Japan than to the east, these trees growing only in hot countries. They called it Bune-sima or the Island Bune, and because they found no inhabitants upon it they marked it with the character of an uninhabited island. On the shores they found an incredible quantity of fish and crabs, some of which were from four to six feet long." This description fits the islands exactly if Kaempfer's conjectures be accepted as to the locality being south and not east, and the crabs as turtles, which for-

merly were very abundant there. In both these errors the Japanese sailors might, under the circumstances, be readily excused. In 1728 a descendant of Ogasawara Sadayori temporarily established communication with the islands again but after this the Japanese took no further interest in them until 1861. It appears, however, from the researches of the late Archdeacon King in the libraries of the British Museum and the Royal Geographical Society that credit belongs to the Spaniard, Ruy Lopez de Villalobos, commanding an exploring expedition that sailed from Mexico sometime in 1543. After reaching the Philippines on August 26, 1543, he sent off a small ship, the "San Juan," to explore in a northerly direction. Sometime about the middle of October this ship sighted some islands which from the description the crew afterwards gave were almost certainly some of the Bonin group. Apparently no landing was effected but that this ship first discovered the group may be confidently accepted, and that some fifty years before the earliest Japanese claim.

On some old charts a group of islands, under the name of Arzobispo Islands, is marked roughly where the Bonins lie and some have considered them identical. The Marianos and Ladrones groups, known to navigators early in the sixteenth century, are not so very far south of the Bonins, and these same sailors might well have visited both groups. Be this as it may, in 1823 an American whaling ship, the "Transit," commanded by Captain Coffin touched at the southern group (Haha-jima). In 1825, the "Supply" an English whaler, visited Port Lloyd (Omura, Chichi-jima) and left a record of her visit by nailing a board to a tree. This board was found by Captain Beechey of the English war-ship "Blossom" which anchored there on June 9, 1827, and found living on the island two castaways from the English whaling ship "William," wrecked there in November, 1826. Captain Beechey stayed until June 15, and a full account of the visit is given in his *Voyage to the Pacific*, II. Chapter 6, pp. 227-240 (1831). During the stay a number of plants were collected and are enumerated with those from Liukiu in Hooker and Arnott's *Botany of Captain Beechey's Voyage*, 258-275. This is the first record of plants being collected on the islands whose very position was not properly charted until this visit. Before leaving a sheet of copper nailed to a board was affixed to a tree and on this the following words were punctured: "H. M. S. 'Blossom,' Captain Beechey, R. N., took possession of this group of islands in the name and on behalf of His Majesty King George, the 14th of June, 1827."

In May of the following year (1828) Captain Lütke, Commander of the Russian corvette "Senjavin" arrived at the Bonins and annexed them in the name of Russia. On board was F. H. von Kittlitz who was evidently no mean artist. His sketches and notes were first published in 1844 in German. In 1861 Berthold Seemann translated and edited them under the title of "*Twenty-four Views of the Vegetation of the Coasts and Islands of the Pacific*." Plates XIV, XV, XVI give views of the vegetation of the Bonin Islands and are accompanied by delightfully written descriptive notes.

In May 1830, an American seaman, native of Bradford, Essex County,

Massachusetts, named Nathaniel Savory, with four other white men and twenty-five Kanakas including some women, sailed from Honolulu, being furthered in their adventure in every way by the British consul, at that time Mr. Richard Charlton. On June 26, 1830, they reached the Bonin Islands and hoisted an English flag which had been given them by Mr. Charlton. In 1842 one Mazarro received the official title of governor from the Acting British Consul for the Sandwich Islands, Alexander Simpson. A vessel from the British China Squadron visited the Islands, and whaling ships frequently put in for supplies of fresh water and vegetables. In 1848 Mazarro died and his widow became the wife of Nathaniel Savory, who finally succeeded to the headship of the Islands and seems to have been a wise and sensible man. In 1851 the English war-ship "Enterprise," under Captain Collinson, visited the Islands and found four of the original white settlers still in possession. On June 14, 1853, Commodore Perry with the American war-ships "Susquehanna" and "Saratoga" anchored at Port Lloyd. He purchased a piece of property there, made Nathaniel Savory his agent, drew up a code of rules which the islanders adopted on August 28, 1853, when Nathaniel Savory was made Chief Magistrate. In October of the same year Commodore Perry dispatched Captain Kelley in the ship "Plymouth" with instructions to survey and take formal possession of the southern group (Bailey Islands) in the name of the United States and to rename them Coffin Islands after their first discoverer, Captain Coffin. This was carried out. A full account of Commodore Perry's visit is recorded in *The Official Report of United States Japanese Expedition* by Commodore M. C. Perry, Vol. I: pp. 196-213 and pp. 282-285.

The next visit of men-of-war after the "Plymouth" was that of four Russian ships which came to Port Lloyd in 1854. This was followed by that of the United States Frigate "Macedonian" by which Commodore Perry sent implements of husbandry and seeds. In a letter he writes "it must be understood that the sovereignty of the Bonin Islands has not yet been settled, the interest taken by me in the welfare and prosperity of the settlement has solely in view the advantage of commerce generally."

In 1855 the United States man-of-war "Vincennes" visited Port Lloyd and remained ten days. In 1861 an attempt to colonize Peel Island was made by Japanese. This failed miserably, and the commissioner and last batch of colonists withdrew to Japan early in 1863 some fifteen months after they cast their lot upon the Islands. In 1874 the United States man-of-war "Tuscarora," while engaged on her line of soundings, visited Port Lloyd. On November 24, 1875, a Japanese steamer the "Meiju Maru" entered the port, formally annexed the Islands and since then Japan has been accepted as the rightful sovereign lord of the Bonin Islands. Two days after the arrival of the Japanese "Meiju Maru" the English war-ship "Curlew" also reached the Bonins with Mr. Russell Robertson, British Consul at Yokohama on board. Subsequently, on March 15, 1876, Mr. Robertson gave an excellent account of the Bonin Islands before the Asiatic Society of Japan, which is published in that Society's *Transactions*, Vol. IV. (1876).

Nathaniel Savory died in 1874 and remained nominal head of the Bonin Islanders until the day of his death. He left behind considerable correspondence which ultimately was placed by his descendants in the hands of Reverend Lionel B. Cholmondeley of St. Andrew's Mission, Tokyo, who incorporated it in a book entitled *History of the Bonin Islands*, which he published in 1915. From this work it appears that during the period of Savory's life many whaling ships touched at the Islands. One or two piratical raids were made on them by ships from China commanded by white men. Also that the colony was augmented by men from whalers and from the island of Guam. On the whole the settlers appear to have lived together harmoniously and for this undoubtedly thanks are due to the wise counsel of Nathaniel Savory. After the Japanese annexations this mixed race of white and Kanaka became Japanese subjects. To-day whaling ships are there no more; Japanese have settled there in numbers, all available land is under crops, chiefly sugar; the seas have been denuded of their swarms of turtles and fish and altogether the struggle for existence made as hard as in Japan proper. Some sixty or seventy English-speaking descendants of the Bonin Islanders remain. A church, under the auspices of the St. Andrew's Mission, has been built and one of the Bonin Islanders, the Reverend Joseph Gonzales, is pastor. The younger generation of adults have taken Japanese wives and in a few years virtually all traces of this interesting colony will have disappeared.

The Bonin Islands lie right within the warm Japan stream (Kuro-suwo) and this accounts for the fact that the mean temperature is higher than that of Hongkong which is five degrees farther south. As proof of this the Coconut ripens its fruit in Bonin but does not in Hongkong. The winters are warmer and the summer less hot than in Formosa and Hongkong. The rainfall, according to the reports of the Central Meteorological Observatory of Japan, averages about 1550 mm. only, which is less than that of Tokyo in Japan. From the statistical tables available there does not appear to be any marked wet or dry season. December, January, March, April, May, June, July and August appear to be the wettest months. My visit was in the latter part of April and early May and we enjoyed fair weather the whole time. Windstorms and thunderstorms are frequent and arise and fall very quickly.

It is a region of old submarine volcanoes and the islands are of this origin. They are considered to have been ejected from the ocean's bed in Eocene times. Geologically they are all alike, consisting of a kind of andesitic lava, called Boninite, and sedimentary agglomerate tufaceous rocks. Limestone from solvent corals is found on the tops of several of the higher peaks — Sekimonzan in particular — where it is weathered into sharp edges which cut one's boots and hands if touched. The surface soil is mainly the reddish clay (laterite) generally so common in tropical regions. Fossil shells (Nummulites) are common, especially in Haha-jima. The coastline is steep and much indented by sea erosion and caves, some of them extensive as on Mukō-jima, are common. The four tiny harbors are due to sinkage

and erosion. Many of the islands have been eroded almost to sea-level and are barren of vegetation or nearly so. At the southern end of Haha-jima, there is a little marshy land but I saw none elsewhere. A few leagues to the south are the Sulphur Islands, a tiny group of volcanic islets of more recent origin than the Bonins, but as I did not visit there no further reference to them will be made.

Leaving Yokohama on the morning of April 18, 1917, we touched at Hachijo and Tori-shima Islands and reached Chichi-jima in the forenoon of April 21. Hachijo is an interesting volcanic island belonging to the Idzu group, and was in old days used as a penal settlement for political offenders. Tori-shima, or Bird Island, is an active volcano over 650 meters high; and bare save for *Vitex ovata* Thunb. and a few herbs at sea-level. It is a breeding place for two species of Albatross (*Diomedea immutabilis* Roths. and *D. albatrus* Pall.) and these birds are so tame that they may be caught by hand. Formerly a Japanese was engaged in the reprehensible trade of exporting feathers and had fully a hundred people engaged on this island killing the birds. The volcano erupted, about ten years ago, killed nearly every inhabitant, and scared the birds from this haunt. The birds are now returning and some five or six people live on the island where landing, except in the calmest weather, is out of the question. The temperature of the water at the landing place is nearly 100° F. On the outward journey we managed to land for a short time but found it impossible to do so on our return.

Seen from the sea, the central and southern groups of the Bonin Islands are extremely picturesque with irregular, bold, black, wall-like cliffs worn into rude shapes. The strong winds which prevail keep the vegetation, in all but the sheltered parts, down to a mean height and from the sea there are no apparent outstanding features of forest-growth. A dense thicket where no cultivation exists is the impression given. As the harbor in Chichi-jima is reached a Palm (*Livistona chinensis* R. Br.) is seen to be especially abundant, and its mop-like crown of gray-green fan-shaped leaves, with their long pendent edges, is reared well above the other vegetation. In gullies, and indeed in every place affording some shelter, grows a variety of trees and shrubs and chief among them is a Cabbage Palm (*Cyphokentia Savoryana* Rehd. & Wils.) which in the past made the Islands famous among whaling and other sea-faring men. This Palm is not abundant today but is in no danger of extermination. On the beaches grow such wide-spread, maritime plants as *Vitex orata* Thunb., *Scaevola Koenigii* Vahl, *Ipomaea biloba* L., *Canavalia obtusifolia* DC. *Caesalpinia Bonducella* Flem., *Hernandia peltata* Meisn., *Calophyllum Inophyllum* L., *Hibiscus tiliaceus* L., and *Erythrina indica* L., all typical of the tropics. From sea-level to high on the mountain slopes a Screw Pine (*Pandanus boninensis* Warb.) is abundant and is perhaps the most common plant on the islands. Where the vegetation has been undisturbed on the hills, and more especially in places protected from the strong winds, trees grow thickly and on their trunks are epiphytes in profusion. Among these epiphytes are such Orchids as *Cirrhope-*

talum boninense Schlecht. and *Luisia boneninsis* Schlecht., and Cryptogams like *Psilotum triquetrum* Sw. *Lycopodium cernuum* L., *Asplenium nidus* f. *intermedia* Mett., *Vittaria boninensis* Chr. and several species of Trichomanes, Polypodium and other Ferns. Three species of Tree Ferns with *Angiopteris evecta* Hoffm. and the scandent *Freycinetia formosana* Hemsl. are prominent features of the vegetation. The undergrowth in the forests is mainly of *Ardisia Sieboldii* Miq., *Rapanea Maximowiczii* Koidz., *Sambucus javanica* Bl. and Ferns, especially Aspidiums. In more open places *Alpinia boninsimensis* Mak. and *Crinum asiaticum* L. abound. But interesting and varied as the vegetation of the Bonins now is they can no longer be described as clothed with luxuriant vegetation from the water's edge to the tops of the highest peaks as they were when visited by the English and Russian ships in 1827 and 1828. In quite recent years Sugar-cane has been introduced and almost all the land suitable for its culture has been cleared by fire and axe and planted. Windbreaks have been found necessary to protect the sugar-cane and for this purpose *Pandanus boninensis* Warb. *Livistona chinensis* R. Br., *Calophyllum Inophyllum* L. and *Boninia glabra* Planch. are much used. On the south end of Haha-jima, an undulating and rather marshy promontory clothed with scrub and coarse grasses, *Casuarina equisetifolia* Forst. imported from Hawaii has been planted and promises to be a success. An attempt to grow *Ficus elastica* Roxb. for rubber has ended in failure, the tree being unable to withstand the wind. A few Cocoanut-trees are grown, the Papaya is common in gardens, also a number of vegetables and ornamental plants, but the only agricultural industry that amounts to anything is sugar-growing.

I spent two weeks on the Islands, visiting Chichi-jima and Ani-jima, the larger islands of the central, and Haha-jima and Mukō-jima the principal ones of the southern group. The other islands have very little vegetation and I had not the time to visit them. The currents are very strong and sailing from island to island in the small boats available is dangerous. Thanks to the courtesy of the Department of Agriculture, Tokyo, every arrangement was made for me to see as much as possible in the time at my disposal. The forestry officer of the Islands, Mr. Hidemasa Otomo, whose knowledge of localities where special plants grow is remarkable, accompanied me everywhere and through his services I saw, with one or two exceptions, every woody plant known to grow on the Bonins. Of those I did not see Mr. Otomo furnished me with specimens from the Government Museum. The trip to and from was unpleasant owing to the poor accommodation on the ship and to the choppy seas, but the stay on the Islands was delightful. My main object was to see and collect *Juniperus taxifolia* Hook. & Arn. and whatever else I could in the time at my disposal. The result so far exceeded expectations that it warrants the publication of this short account of the whole ligneous vegetation.

The first account of the flora of the Bonin Islands is that of Hooker & Arnott in their *Botany of Captain Beechey's Voyage*, pp. 258 to 274 where 42 plants are recorded from Bonin, 23 of them being woody. Figures of two

new trees (*Sideroxylon ferrugineum* Hook. & Arn., *Elaeocarpus photiniaefolius* Hook. & Arn.) and of an *Evonymus*, now considered a new species (*E. boninensis* Koidz.), are given. This collection was the only one of importance made so far as I can discover until the Japanese began to take a serious interest in botany. Some plants were collected on the Commodore Perry Expedition, for Gray in his *Botany of Japan* (388) says, "Mr. Wright found the Californian *Photinia arbutifolia* at the Bonin Islands along with the *Osteomeles* of the Sandwich Islands. On page 398 Gray describes a new Composite as *Ixeris*? *Ixeridium linguaeifolia* and says it was collected by Wright in the Bonins. Maximowicz afterwards referred this plant to the genus *Crepis*. Decaisne described the *Photinia* mentioned by Gray as a new species, under the name of *Photinia Maximowiczii*. In the *Ann. Sci. Nat.* sér. 5, XIV. 309 (1872) Planchon describes an endemic Rutaceous genus *Boninia* with two species and mentions a specimen in Herb. Acad. Petrop. and another in Herb. Hook., no. 56. It would appear that it was collected by the Russians and possibly by Beechey. It is evident that men of the ships which visited the Bonin Islands after Captain Beechey made collections of plants but they do not appear to have been systematically described.

In the *Journal of the College of Science, Tokyo*, XXIII, art. 10 (1908) is a phytogeographical article by H. Hattori on a very elaborate plan but its usefulness is curtailed by the author enumerating every name given to Bonin plants irrespective of their correct application. He enumerates 70 families comprising 164 genera and 220 species as growing on the Bonin Islands. Of these 54 species are Cryptogams and 74 phanerogamous herbs. Of the 92 woody plants 34 are now known to belong to other species and eight are suffruticose, roadside weeds wide spread in the tropics. He regards 11 species of woody plants as endemic. One family Hattori includes (*Capparidaceae*) must be eliminated, for the plant he refers to here (*Coronopus didymus* Smith) belongs to the Cruciferae. His "*Gardenia radicans*" is *G. augusta* Merr. and his "*Zanthoxylum piperitum*" is the same as *Z. Arnottianum* Maxim. both of which he includes.

In the last few years the Japanese botanists and especially Messrs. Makino, Nakai and Koidzumi, have described many new species from the Bonin Islands. Today the ligneous flora excluding those for ornamental or æsthetic purposes introduced by man is known to belong to 57 families comprising 100 genera and 107 species and 5 varieties. Of these six are now described for the first time in this Journal. These woody plants are divisible into 43 trees, 54 shrubs and 15 climbers. Of these one genus and fifty-four species and four varieties are endemic, thirty species are widely spread in the tropics, and seventeen species grow also in south Japan, Liukiu, Formosa and southern China. Considering the proximity to southern Japan and Liukiu the number of species common to these areas and to the Bonins is remarkably small. The Bonin Islands are really very isolated and being entirely erupted from the ocean their origin sufficiently explains the high percentage of endemic plants; nevertheless, the flora is in all its essential characters an outpost of the Chino-Malayan floras and is not

Polynesian. The Cocoanut has, of course, drifted to the Bonins in the ocean currents, but it is quite a rare tree though now its planting is being sparingly undertaken. The *Hernandia* doubtless came in the same way for its fruits with their pink bladder-like vesicle are specially adapted for such distribution; also the *Calophyllum* and *Terminalia*. Migratory wild fowl doubtless brought others either in their crops, on their feet or among their feathers. But apart from a coastal fringe of wide-spread tropical and subtropical plants the flora is mainly endemic. Prior to its general clearance for sugar-cane it must have been densely covered with ligneous growth. The windstorms must always have kept this growth comparatively low and even, except in sheltered places, just as it occurs today.

Though the Islands are small and the area of the three groups inconsiderable there is some marked dissimilarities in their ligneous growth. For example *Morus* grows only on Haha-jima, the *Juniper* grows on Chichi-jima and Ani-jima and Mukō-jima but not on Haha-jima. On Mukō-jima no Tree Fern, *Freycinetia* nor *Viburnum* grows. On Haha-jima *Juniperus*, *Distylium*, *Osteomeles* and *Viburnum* do not grow, otherwise this island supports probably the richest flora of the whole group, certainly on it grow the largest trees. From the whole group Bamboos, Mangroves, Tree Figs (such as *Ficus retusa* L., *Ficus Wightiana* Wall.), the climbing *Ficus pumila* L., *Myrica rubra* S. & Z., *Garcinia spicata* Hook. and *Bischofia javanica* Bl. are absent though they might reasonably be expected to occur. The presence of a shrubby *Lobelia* is interesting since no other species of this section grows in eastern Asia. The absence of any species of *Rhododendron* makes this group unique among the islands of eastern Asia. The presence of a shrubby *Statice* is also a noteworthy feature whilst the absence of the wide-spread *Pandanus tectorius* Soland. and the presence of such a well-marked endemic species as *Pandanus boninensis* Warb. is most surprising. The maritime *Tournefortia argentea* Linn. f. is rare, but *Cassytha filiformis* L., *Ipomaea biloba* L. and *Scaevola Koenigii* Vahl, its companions on Liukiu, are abundant. The *Freycinetia formosana* Hemsl. abounds, forming dense jungle on the upper slopes of the highest peak (Chibusa-yama) on Haha-jima, and in the forests scaling the highest trees. The only other place it grows outside of the Bonins is in the extreme north of Formosa which is the type locality, where it is both local and rare.

The herbs which grow on the Bonins are not noteworthy: among the Monocotyledons some of the Orchids, and Scitamineous plants are pretty and *Crinum asiaticum* L. is handsome, but the Dicotyledonous herbs are mostly wide-spread roadside weeds and weeds of cultivation. The Ferns are lovely, their variety considerable and their number multitudinous. I could not spare the time to collect them, to my lasting regret. The three Tree Ferns are *Cyathea spinulosa* Wall., *Alsophila latebrosa* Hook., and *A. Bongardiana* Mett., and certainly they are as handsome as any of their family. Trees from 8 to 10 m. tall crowned with tabular heads of wide-spreading green fronds and likewise the old type *Angiopteris evecta* Hoffm. are abundant. Also the striking Birdsnest-Fern (*Asplenium nidus* var. *inter-*

media Mett.), a spreading, vase-shaped plant with a rosette of bright green leaves, a meter long abounds on the limestone and on trees, but nowhere more so than on Sekimonzan. On this mountain I did collect the endemic Hounds-tongue (*Scolopendrium Ikenoi* Makino) with its 7 cm. long, cordate-acuminate, delicate fronds. It is outside the province of this paper to enter further into details regarding the Ferns, but since they are the dominant undergrowth in the forests and everywhere abundant, they are a most important feature of the flora of the Bonin Islands.

CLIMBERS

Freycinetia formosana Hemsl.
Smilax china L.
Piper futokadsura Sieb.
Clematis boninensis Hay.
Cassytha filiformis L.
Canavalia obtusifolia DC.
Mucuna gigantea DC.
Vigna retusa A. Gray

Colubrina asiatica Brongn.
Cissus japonica Willd.
Elaeagnus rotundata Nakai
Trachelospermum divaricatum Kanitz
Ipomaea biloba L.
Argyreia tiliaefolia Wight
Psychotria serpens var. *macrophylla*
 Koidz.

There are fifteen climbers as shown above and they belong to 12 families and fifteen genera. Of the two Monocotyledonous species the *Smilax* is a common plant, on the larger islands at least, and calls for no special remark. The *Freycinetia* on the other hand ranks with the *Clematis*, the *Elaeagnus* and the *Trachelospermum* as one of the four principal climbers of the Islands. As before mentioned it forms dense impenetrable thickets on the upper mountain slopes and in the forest scales the highest trees. The stems put out roots which cling to the moist tree-trunks and rocks. The dark green, spirally arranged leaves are smooth on the margin and flaccid, and the finger-like fruit, in a cluster of three, is red and soft and disappears soon after it is ripe in August. When in Formosa I closely examined the species in the type locality and could find no difference between it and the Bonin plant. The *Piper* is a wide-spread species in south Japan, Liukiu, and Formosa and in the Bonins it is common on trees and rocks. Its orange-yellow spicate flowers are quite attractive. The *Clematis* is allied to the Japanese *C. paniculata* Thunb. and is common in thickets and on the margins of forests where it can enjoy the sunlight. The *Cassytha* is not common and, curiously enough, grows on the grassy hilltops and not on the seashore, its normal habitat in Liukiu, Formosa and the other places where I have met with it. Of the three Leguminous genera the *Mucuna* is rare and is confined to shady forests and thickets. The *Canavalia* and *Vigna* are scarcely woody and abound in open grassy places near the sea, and if the site is brackish and swampy so much the better; both are cosmopolitan in the tropics. The *Mucuna* is also widely spread, though there is a possibility of the Bonin plant with its pink flowers being a distinct but critical species. The *Colubrina*, which in growth and appearance strongly suggests *Celastrus*, I saw on Haha-jima in one place only and it is evidently rare. The *Cissus* I did not see and I am indebted to Mr. Otomo for a specimen; it is certainly

strange that a plant so abundant from Japan to Formosa and through China should be so rare in the Bonins. The *Elaeagnus* is perhaps the largest of the Bonin climbers and finds its way to the tops of the tallest trees, from which its rope-like stems hang down. It is near *Elaeagnus macrophylla* Thunb. and is an autumn-flowering species. I could find neither flower nor fruit. The *Trachelospermum* has relatively large, inodorous flowers, and in late April and May is singularly attractive and conspicuous on rocks, tree-trunks and shrubs in sunny places. On the seashore the cosmopolitan *Ipomaea biloba* L. is common with its string-like stems firmly anchored at and above tide-mark. The climbing *Argyreia tiliacifolia* Wight grows only near habitations and was undoubtedly introduced from Hawaii. Lastly the *Psychotria* with its leaves much broader than that of the wide-spread type, grows on rocks and tree-trunks in the forests although it cannot be described as common.

SHRUBS

<i>Piper Postelsianum</i> Maxim.	<i>Melastoma</i> sp.
<i>Boehmeria boninensis</i> Nakai	<i>Vaccinium bracteatum</i> var.
<i>Procris laevigata</i> Bl.	<i>Wrightii</i> Rehd. & Wils.
<i>Pseudixus japonicus</i> Hay.	<i>Statice arbuscula</i> Spr.
<i>Bryophyllum calycinum</i> Salisb.	<i>Symplocos Otomoi</i> Rehd. & Wils.
<i>Pittosporum boninensis</i> Koidz.	<i>Ligustrum japonicum</i> Thunb.
<i>Osteomeles anthyllidifolia</i> Lindl.	<i>Osmanthus insularis</i> Koidz.
<i>Rubus Nishimuranus</i> Koidz.	<i>Geniostoma glabra</i> Matsum.
<i>Caesalpinia bonducella</i> Flem.	<i>Vinca rosea</i> L.
<i>Lespedeza striata</i> Hook. & Arn.	<i>Asclepias curassivica</i> L.
<i>Leucaena glauca</i> Benth.	<i>Tournefortia argentea</i> Linn. f.
<i>Mimosa pudica</i> L.	<i>Callicarpa glabra</i> Koidz.
<i>Rhynchosia minima</i> DC.	<i>Callicarpa Nishimurae</i> Koidz.
<i>Evodia Kumagaiana</i> Rehd. & Wils.	<i>Vitex ovata</i> Thunb.
<i>Zanthoxylum Arnottianum</i> Maxim.	<i>Lycium</i> sp.
<i>Phyllanthus Niruri</i> L.	<i>Myoporum boninense</i> Koidz.
<i>Ilex Matanoana</i> Mak.	<i>Gardenia augusta</i> Merr.
<i>Ilex Mertensii</i> Maxim.	<i>Morinda citrifolia</i> L.
<i>Evonymus boninensis</i> Koidz.	<i>Morinda umbellata</i> L.
<i>Dodonaea viscosa</i> Jacq.	<i>Oldenlandia cordata</i> Matsum.
<i>Triumfetta subpalmata</i> Soland.	<i>Oldenlandia Grayi</i> K. Sch.
<i>Malvastrum tricuspidatum</i> , A. Gray	<i>Rubiacea</i>
<i>Sida rhombifolia</i> L.	<i>Sambucus javanica</i> Bl.
<i>Eurya boninensis</i> Koidz.	<i>Viburnum japonicum</i> var. <i>bonin-</i>
<i>Stachyurus macrocarpus</i> Koidz.	<i>simense</i> Mak.
<i>Wikstroemia pseudoretusa</i> Koidz.	<i>Lobelia boninensis</i> Koidz.
<i>Eugenia boninensis</i> Koidz.	<i>Scaevola Koenigii</i> Vahl
<i>Eugenia microphylla</i> Abel	<i>Cacalia crepidifolia</i> Nakai

The 54 shrubby plants are distributed among 35 families and 50 genera; 24 species and one variety are endemic. The *Bryophyllum*, *Leucaena*, *Rhynchosia*, *Mimosa*, *Lespedeza*, *Phyllanthus*, *Triumfetta*, *Malvastrum*, *Sida*, *Vinca* and *Asclepias* are roadside weeds and very probably have been quite recently introduced. I did not collect the *Mimosa* and *Lespedeza*.

The *Pseudixis* is a pest and grows on nearly every kind of shrub and tree. The Piper, *Procris*, *Sambucus*, *Boehmeria* and the two *Oldenlandias* are not very woody; the first three are common as undergrowth in moist shady places and the two latter prefer more sunny places. The *Caesalpinia*, *Wikstroemia*, *Statice*, *Vitex*, *Lycium*, *Myoporum*, *Tournefortia*, *Lobelia* and the *Scaevola* are littoral plants. The *Myoporum* I did not see, but it was described from Chichi-jima by Koidzumi in 1918. The *Vitex* is a useful plant for holding down sand, shingle, and loose earth, and is always found at and near sea-level. The *Scaevola*, with its fleshy leaves and stiff branches, is one of the most common shrubs on the island from sea-level to a few hundred feet above in open windswept places, and is quite a handsome plant. The *Tournefortia* is rare and I saw a few plants in two localities only, the *Lycium* I only saw on Mukō-jima on bare rocks within reach of the sea's spray, but the *Lobelia* is common in many places but in none more so, however, than in Mukō-jima; it is an interesting extension of the known distribution of the genus. The *Statice* I did not see growing and it is probably wrongly determined. The *Wikstroemia* is widely scattered and is quite common. The wide-spread *Caesalpinia* is not very abundant; the *Pittosporum* is plentiful and is remarkable for its globose, woody, strongly decurved fruit. I was much interested to find *Osteomeles anthyllidifolia* Lindl. which seems to be identical with the Hawaiian plant. It is absent from Haha-jima but is common on Chichi-jima, Ani-jima and other islands. When growing freely its slender branches arch gracefully and the leaves are only slightly hairy, and from this it varies to a stunted shrub hugging rocky ground with leaves densely covered with a white tomentum. The fruit is said to be as often white as black and is edible, being considered a wild plum by the Bonin Islanders. The two Rutaceous shrubs are uncommon and so is *Ilex Matanoana* Mak., but the other *Ilex* is very plentiful; its thick, shining green leaves are reddish when young and are variable in size; sometimes it is almost a tree. It is the plant referred to by Hooker & Arnott (*Botany of Beechey's Voyage*, 261). Makino has described (in *Jour. Jap. Bot.* 1. 21 [1917]) an *Ilex bonincola*, but from the description I think this is simply a state of his *Ilex Matanoana* with large leaves such as are found on free-growing shoots. The *Evonymus* is rather rare, at least on Haha-jima where I collected it. It is well figured by Hooker & Arnott (l. c. 54, 261) who erroneously referred it to *Evonymus japonicus* Thunb. The *Dodonaea* and *Eurya* are common and call for no special remark, but the *Stachyurus* is rare and though similar to the Japanese species in habit and flowers has a remarkably large, rounded fruit. It is a very distinct and interesting addition to the genus. The *Eugenia boninensis* Koidz. I did not see, but the other species is a common shrub, from 0.6 to 2 m. tall with edible fruit, and is often stoloniferous in habit. It is a feature of the rather bare hilltops of Ani-jima. The *Melastoma* I did not see and the *Vaccinium* only on Ani-jima where it is a bush from 2 to 3 m. high. The *Symplocos* I did not see growing, the specimen being given to me by Mr. Otomo. The *Ligustrum* is very plentiful and differs in no way from speci-

mens collected in Japan and Liukiu. The *Osmanthus* is abundant and is often 6 m. high. It seems to be closely related to the Liukiu *Osmanthus bracteatus* Matsum. The two *Callicarpas* are fairly common shrubs in the more open country; in *Callicarpa glabra* Koidz. the undersurface of the leaves often glistens with lepidote glands. The wide-spread *Gardenia augusta* Merr. (better known as *Gardenia florida* L.) is one of the most common shrubs and grows quite tall. The Rubiaceous shrubs not already mentioned are common undergrowth in forests and shady places. The *Viburnum* has handsome foliage and flowers but seems to be confined to the Chichi-jima group. The *Cacalia* is not common and is a bush from 2 to 3 m. high, much branched, with gray, corky bark and grows on the margins of woods. Nakai describes another species *C. ameristophylla*, but this is probably only a condition of the *C. crepidifolia*.

TREES

<i>Juniperus taxifolia</i> Hook. & Arn.	<i>Erythrina indica</i> Lam.
<i>Pandanus boninensis</i> Warb.	<i>Boninia glabra</i> Planch.
<i>Cocos nucifera</i> L.	<i>Zanthoxylum ailanthoides</i> var. <i>inermis</i> Rehd. & Wils.
<i>Livistona chinensis</i> R. Br.	<i>Claoxylum centenarium</i> Koidz.
<i>Cyphokentia Savoryana</i> Rehd. & Wils.	<i>Putranjiva integerrima</i> Koidz.
<i>Celtis boninensis</i> Koidz.	<i>Melia Azedarach</i> L.
<i>Trema argentea</i> Bl.	<i>Sapindus mukorossi</i> Gaertn.
<i>Ficus boninsimae</i> Koidz.	<i>Elaeocarpus photiniaefolius</i> Hook. & Arn.
<i>Ficus lidaiana</i> Rehd. & Wils.	<i>Hibiscus tiliaceus</i> L.
<i>Ficus Nishimurae</i> Koidz.	<i>Hibiscus tiliaceus</i> var. <i>glabra</i> Matsum.
<i>Morus boninensis</i> Koidz.	<i>Schima boninensis</i> Nakai
<i>Calpidia Nishimurae</i> Rehd. & Wils.	<i>Calophyllum inophyllum</i> L.
<i>Cinnamomum scrobiculatum</i> Nakai	<i>Terminalia catappa</i> L.
<i>Machilus boninensis</i> Koidz.	<i>Eugenia oxygona</i> Koidz.
<i>Machilus kobu</i> Maxim.	<i>Fatsia oligocarpella</i> Koidz.
<i>Machilus pseudokobu</i> Koidz.	<i>Ardisia Sieboldii</i> Miq.
<i>Neolitsea gilva</i> Koidz.	<i>Rapanea Maximowiczii</i> Koidz.
<i>Neolitsea boninensis</i> Koidz.	Sapotacea?
<i>Hernandia peltata</i> Meisn.	<i>Sideroxylon ferrugineum</i> Hook. & Arn.
<i>Distylium lepidotum</i> Nakai	<i>Symplocos boninensis</i> Rehd. & Wils.
<i>Photinia Maximowiczii</i> Decne.	<i>Paralstonia clusiacea</i> Baill.
<i>Raphiolepis integerrima</i> Hook. & Arn.	

We now come to the most interesting group, namely, the trees of which there are 41 species and two varieties belonging to 37 genera and 27 families. Of these 26 species and two varieties are endemic. The solitary Gymnosperm *Juniperus taxifolia* Hook. & Arn. is one of the most interesting of the Bonin trees and the one my visit was principally concerned with. It grows on Mukō-jima, Chichi-jima and Ani-jima and is today most plentiful on the last. In the sheltered gullies growing with Palms and Tree Ferns it is a tree 15 meters tall with a trunk 1.3 meters in girth and ascending-spreading branches and long, slender branchlets hanging straight down. Such trees are as ornamental and beautiful as any Juniper can be. On windswept areas it is a low mat-like shrub hugging the ground closely, with gnarled

and twisted branches and between these extremes there is every conceivable condition, but the tree form is rare. The leaves are bright green and not pungent, and the fruit is shining chestnut brown and glaucous along the edges of the confluent scales. Formerly it was a common tree and was called "Spruce" by the original Bonin Islanders and used by them for posts in their houses and for fuel. It is peculiar to these Islands but in books the, Liukiu Juniper, which is nothing but the wide-spread littoral *J. conferta* Parl., and the Formosan and Chinese *J. formosana* Hay, have been confused with it. It had not been introduced to cultivation until I sent to the Arnold Arboretum seeds gathered on my visit.

Of the four Monocotyledonous trees three of them together form the dominant features of the whole arborescent flora of the Bonins. The Screw Pine (*Pandanus boninensis* Warb.) is a handsome species often 8 meters tall with many rope-like aerial roots and a dichotomously much-branched crown of dull green leaves. On young plants the leaves are clear green. The fruit is orange-colored, as large as a man's head and very heavy; the seeds are edible and are much sought after by the Fruit-bat (*Pteropus pselaphon* Andersen), the only mammal indigenous to the Islands. The *Pandanus* is common from sea-level to mountain tops but is a light-demanding tree and does not thrive in the dense forest shade. It is probably the most common tree on the Islands and is much used as a windbreak with the Fan Palm (*Livistona chinensis* R. Br.) and *Calophyllum Inophyllum* L. around sugar-cane plantations.

The Cocoanut has been sparingly planted by Japanese but it also occurs as a strand tree although it is rare. Planted in front of the cottage of the Rev. J. Gonzales at Omura, Chichi-jima, is a fruiting Cocoanut-tree grown from a nut picked up on the beach and planted by him a number of years ago. The other two Palms are abundant, and it was the Cyphokentia together with fresh water that made the Islands famous in the days of whaling ships. It is the Cabbage Palm mentioned in all the accounts of the Islands. As a vegetable it is the core of the stems of young trees say 2 meters tall and not more than 20 centimeters in girth, that is esteemed and which I tried and found delicious, but this means the destruction of the plants. In spite of this annihilation carried on for nearly a century this Palm is still plentiful in gullies on the sparsely populated Mukō-jima and Ani-jima. It is not uncommon on Chichi-jima but comparatively scarce on Haha-jima, the two large islands. It is a slender tree from 10 to 15 meters tall, crowned with a tuft of pinnate, arching, dark green leaves. It is the "Areca oleracea" of Captain Beechey and has been wrongly referred by botanists to *Ptychosperma elegans* Bl. which is an Australian Palm. The Fan Palm is *Livistona chinensis* R. Br. which I have also seen growing wild on Aharen Island of the Liukiu group, and by Japanese botanists is considered to be indigenous in parts of south Japan. The oval, bluish green fruit is a favorite food of pigeons, and thus might easily be carried long distances when the birds are blown out to sea by storms. It is a sturdy tree often 16 meters tall, rearing itself above its companion plants and topped by a mop-like head of large,

gray-green, fan-shaped leaves, pendent at the edges. It is unlike other trees on the Islands, and being common is a decided feature. Behind the town of Omura there is a preserved forest and here this Palm is abundant. Also it is plentiful on Mukō-jima and Ani-jima and is also used as a windbreak as already mentioned. On young plants the petioles are armed with strong, curved prickles, but this armature disappears as the adult condition is reached. Although its leaves get sadly tattered the tree is seldom blown down by the windstorms, fierce though they are. Five (*Hernandia peltata* Meisn., *Erythrina indica* L., *Hibiscus tiliaceous* L., *Calophyllum Inophyllum* L., *Terminalia catappa* L.) of the Dicotyledonous trees are strand trees widespread in the tropics. The *Terminalia* with its tiers of branches spreading at right angles to the trunk and the *Hibiscus* are not common, but a smooth-leaved form of the latter (var. *glabra* Matsum.) is abundant on the mountains where in the forests it is often 3 meters in girth of trunk and 15 meters tall. The wood of both is used to make the struts to which the outrigger is attached on canoes. The *Erythrina* and *Hernandia* are ugly trees when bare of leaves and have many warty excrescences on the trunks. The fruit of the *Hernandia* is remarkably adapted for distribution by ocean currents as previously told, and the wood is soft and is used in the hulls of canoes. The *Calophyllum* is the handsomest of these strand trees and decidedly useful both as a windbreak and for its wood, which is beautifully figured. Formerly whaling ships traded in it considerably, and under the name of "Tremona" it was much used and valued by the Bonin Islanders. Around the more sheltered coves at sea-level it grows 25 m. tall and has a trunk 3 m. in girth and a shapely umbrageous crown and dark green leaves. Its globular, plum-like fruit contains a very hard seed which will germinate after long immersion in sea-water.

The *Celtis* ranks among the finest of the genus. In the bit of virgin forest on Kuwanoki-yama (Mulberry Mt.), Haha-jima, and similar other places it is often 25 m. tall with a trunk 5 m. in girth above the large buttressed roots. The bark is smooth, pale gray, and the fruit orange-colored, the size of a large pea and edible; the green shoots and leaves are used as cattle feed.

The *Trema* and the three *Figs* are small trees endemic and unimportant, but the Mulberry or "Kuwa" of the Japanese is the most valuable timber tree on the Islands. The largest living tree I saw grows with the *Celtis* and was about 23 meters tall and 3 meters in girth of trunk, but a fallen, dead tree I measured was 9 meters in girth of trunk. The wood is yellowish when first cut and changes to nearly black with age. It is finely figured, heavier than water, and is especially valuable for cabinet work though difficult to handle. This Mulberry is an upstanding tree with a straight trunk, clean of branches for 6 or 7 meters, has dark brown, scaly, fissured bark which flakes off, and large, dark green cordate leaves. The flowers appear in October and the fruit is ripe in December. The value of its wood has almost brought about the tree's extinction, in fact it has done so on Chichijima, but the Japanese Government is now planting it, and felling it is prohibited.

The *Calpidia*, or *Pisonia* as it was formerly called, is in bulk the biggest tree now on the Bonins being often 8 meters in girth of trunk and from 20 to 25 m. tall. The bark is smooth, gray and the branches massive and well clothed with large dark green leaves, but the wood, although fibrous, is brittle, soft and absolutely useless. It is everywhere common but the largest trees are found only on Sekimonzan in Haha-jima.

With six species, all endemic, Lauraceae is the family richest in trees but they are all of small size and, except the *Cinnamomum*, of no particular value. The *Cinnamomum* was called by the Bonin Islanders "Sassafras," and among the published correspondence of Nathaniel Savory are many references to this tree, especially from his acquaintances down on the island of Guam who often ask for "Sassafras bark and seed." Another name for it was "Tea Tree" and its wood was used for making hulls of canoes. I am a little sceptical about Koidzumi's *Machilus pseudokobu* being distinct from Maximowicz's species, but my material is insufficient. My visit was not a seasonable one for Lauraceae, as fruiting material is so necessary for determination in this family.

The *Distylium* is more often a bush than a tree and the same is true of the *Photinia* and *Raphiolepis*. The last named furnished the wood for making tool-handles, being both tough and strong and not too heavy. It was first known as "Axe-handle-wood" and then as illiteracy became more general it became "Areki-san-doru" and finally "Sandal-wood," and as such is mentioned by Robertson. This small tree is common everywhere and its bloomy black, globose fruit in upright clusters are most handsome. I prefer to keep it as a species under Hooker & Arnott's name than to refer it as a variety to the variable Japanese *R. umbellata* Makino, more generally known under Siebold and Zuccarini's name of *R. japonica*.

The *Boninia* as the sole endemic genus is interesting. More often a large bush than a tree, yet it is sometimes 10 meters tall with a trunk 0.6 m. in girth, clothed with smooth gray bark; the leaves are persistent, variable in size, usually shining, but often dull, green. It is dioecious and the small white flowers are borne in axillary cymose clusters; the fruit is capsular. It is everywhere abundant and is often used as a hedge plant. Planchon (in *Ann. Sci. Nat.* sér. 5, xiv. 310 [1872]), founded the genus on material from Herb. Acad. Petrop. and in Herb. Hook. no. 56, and distinguishes two species (*Boninia grisea* and *Boninia glabra*) on trivial characters. Koidzumi (in *Tokyo Bot. Mag.* xxxi. 260 [1917]) reduces them to one species (*B. glabra*) and rightly so, I think, though he is in error in citing them as *nomina nuda*. The other Rutaceous tree here described as a new variety of *Zanthoxylum ailanthoides* Sieb. & Zucc. was known to the Bonin Islanders by the sinister name of "Poison Tree." It is very common, but the only large trees I saw grew on Mulberry Mt. and were 20 meters tall and from 2 to 2.5 meters in girth of trunk. The bark is smooth, pale gray, and the pinnate leaves are 0.3 meters long. It has not the prickles found on the Japanese type with which it has been confused.

The *Claoxylum* is a recently described species and is a slender tree con-

fined to the forest shade. The Putranjiva is the "White Iron-wood" of the Bonin Islanders and it is in request for general building purposes. It is a common tree from 15 to 20 meters tall and from 1.5 to 2.5 meters in girth of trunk and has gray bark. It was a surprise to me to find the Pride of India (*Melia Azedarach* L.) luxuriating in the depth of the forest on Mulberry Mt. and elsewhere. Until then I knew it only as a tree delighting in open country or the margins of woods, but since I have seen it in the rich forests of northeastern Formosa. On the Bonins it is a common tree and on the mountain mentioned grow specimens 25 meters tall and 6 meters in girth of trunk. The wood is of excellent quality, beautifully figured and was known to the Bonin Islanders as "Cedar," and by them employed to make the floors of their houses. In its wide distribution this tree has been helped by its seed, which can be carried in the crops of migratory birds and by ocean currents. Also man's fondness for this tree has caused it to be carried to so many distant lands that it is not easy to say just when and where it is indigenous. The Sapindus is another wide-spread tree in the Orient, but on the Bonins I saw none of any size though small trees were plentiful in the forests on Haha-jima.

The Elaeocarpus is endemic (though the Japanese *E. ellipticus* Mak. has been confused with it) and very abundant, growing from 10 to 20 meters tall and from 0.5 to 2.5 meters in girth of trunk. The wood was used by the Bonin Islanders for roofing purposes and the tree known as "Shaddock." The Schima is also peculiar to the Bonins and formerly large trees were abundant, but clearings made for a foolish and foredoomed-to-failure experiment to grow Rubber (*Ficus elastica* Roxb.) resulted in the destruction of many handsome trees. This Schima grows from 20 to 25 meters tall with a trunk from 3 to 4 meters in girth and a round-topped crown of massive branches often 15 to 20 meters through. It goes by the name of "Rose-wood" and the timber is considered valuable by the Japanese.

The *Eugenia oxygona* Koidz. is the "Red Iron-wood" of the Islanders and is a slender tree from 4 to 6 meters tall with brownish scaly bark and is everywhere common. The Fatsia is a small tree common among the undergrowth of the forest and like its Japanese relative has handsome foliage.

The two Myrsinaceous trees, Ardisia and Rapanea, form the principal arborescent undergrowth in the forests and are also common in thickets. They are slender trees, seldom more than 8 meters tall; the wood of the Rapanea is reddish and that of the Ardisia white. The latter was known as "White Oak" to the early settlers and by them used in house-building. It is possible that the Bonin Ardisia, which has dark reddish fruit, should be regarded as a variety of the wide-spread type.

The Sideroxylon or "Black Iron-wood" of the Islanders is one of the commonest plants on the Bonins but large trees are now rare. On the windswept hilltops it forms scrub from a foot to a yard high, in less exposed places it is a small to a moderate-sized tree, and on Sekimonzan in a bit of sheltered virgin forest are trees 30 meters tall and 5 meters in girth of trunk with wide-spreading buttressed roots sprawling on the ground like

hundreds of large wriggling snakes. The trunk is deeply furrowed and bilowy in outline and is clothed with firm, nearly smooth, gray bark. It is a singular tree, striking in appearance, and the contrast between young leaves covered with a soft rufous pubescence and the shining green of mature leaves is most marked. This tree is also considered to grow in Formosa, but the trees pointed out to me as such appeared to be different. The other Sapotaceous tree if, indeed, it really belongs to his family, may also be a species of *Sideroxylon*, but I saw only one tree without flowers and fruit. It was small — 6 meters tall and 0.3 m. in girth — and was said to bear yellow, flattened, round, edible fruits. It grows on the upper-middle slopes of Chibusa-yama, Haha-jima.

The *Symplocos* and *Paralstonia* are both small trees, the first I found on Mukō-jima only, but the *Paralstonia* is everywhere plentiful and is the "Yellow-wood" of the Islanders; it is a tree sometimes 10 meters tall by one meter in girth of trunk.

CONCLUSION

The Bonin Islands are too small and too windswept to ever become important in tropical agriculture. Sugar-cane grows well and the high price of sugar during the last few years has caused its extensive planting on the Bonins as elsewhere. When sugar falls in price it is doubtful if its cultivation at a profit can be maintained in such small, out-of-the-way places with the consequent high transport rates. The turtles are now scarce and the waters have been very closely fished. With a decline in its sugar industry following that of its marine products the future of these islands is not particularly bright and in all probability many of the Japanese will leave them. With these thoughts in mind it seems worth while to note down the few trees which have been introduced to the Islands and the favorite garden plants of the early settlers, since as they escape in a century's time future visitors may think them indigenous. The Bonin Islanders do not appear to have introduced many plants economic or otherwise. The Papaya (*Carica Papaya* L.) is common and yields excellent fruit; the Banana, formerly a most important crop, has been attacked by disease and has virtually disappeared from the Islands. The Lemon grows and fruits well and in one garden grows a very large tree of a kind of "Grape fruit." The present owners know nothing of its history but most probably it came from the island of Guam. The Passion fruit (*Passiflora edulis* Sims), a Guava (*Psidium Cattleianum* Sab.) have also been introduced and so too has *Ficus retusa* var. *nitida* Miq., the common Banyan Fig of Luikiu and Formosa. For ornament in the gardens I noted *Russelia juncea* Zucc., Poinsettia (*Euphorbia pulcherrima* Willd.), Oleander (*Nerium odorum* Soland.) Pomegranate (*Punica Granatum* L.), two Hibiscus (*H. rosa-sinensis* L. and *H. schizopetalus* Hook.) and *Cuphea eminens* Planch. & Lindl. As hedge plants *Lagerstroemia subcostata* Koehne, and a Jasmine (*J. undulatum* var. *elegans* Hemsl.) are common and the latter has escaped. The Japanese have introduced a number of plants and in Omura, Chichi-jima, there is

a small experimental garden, but the above-mentioned plants should be credited to the early white settlers. For forest planting the Japanese have introduced, from Honolulu, I believe, *Casuarina equisetifolia* Forst. and have also planted *Acacia confusa* Merrill, *Pinus luchuensis* Mayr and *Ficus elastica* Roxb. To their temple ground the Japanese priests have introduced *Ficus pumila* L. and *Bursera liukiuensis* Mak.

For native plants which the original white settlers found useful or interesting they most naturally coined names, and these are given in Robertson's paper already mentioned on page 100. To aid in the identity of these I was fortunate enough to enlist the services of the Rev. J. Gonzales who has known the plants by their vernacular names from his childhood. He procured me specimens of all but one or two, and the list of these with their scientific names may fitly conclude this sketch of the ligneous flora of the interesting Bonin Islands.

- Axe-handle-wood (*Raphiolepis integerrima* Hook. & Arn.)
- Cedar (*Melia Azedarach* L.)
- Hao-wood, Mountain (*Hibiscus tiliaceus* var. *glabra* Matsum.)
- Hao-wood, Narrow leaf (*Raphiolepis integerrima* Hook. & Arn.)
- Hao-wood, Soft (*Hernandia peltata* Meisn.)
- Hao-wood, Swamp (*Hibiscus tiliaceus* L.)
- Iron-wood, Black (*Sideroxylon ferrugineum* Hook. & Arn.)
- Iron-wood, Red (*Eugenia oxygonia* Koidz.)
- Iron-wood, White (*Putranjiva integerrima* Koidz.)
- Kehop (*Crinum asiaticum* L.)
- Milk-wood (*Ficus boninsimae* Koidz.)
- Mulberry (*Morus boninensis* Koidz.)
- Plum, Wild (*Osteomeles anthyllidifolia* Lindl.)
- Poison-wood (*Zanthoxylum ailanthoides* var. *inermis* Rehd. & Wils.)
- Rose-wood (*Schima boninensis* Nakai)
- Sage tree, Wild (*Vitex ovata* Thunb.)
- Sassafras (*Cinnamomum scrobiculatum* Nakai)
- Shaddock (*Elaeocarpus photiniaefolius* Hook. & Arn.)
- Spruce (*Juniperus taxifolia* Hook. & Arn.)
- Tea-wood tree (*Cinnamomum scrobiculatum* Nakai)
- Tremona or Tomana-wood tree (*Calophyllum inophyllum* L.)
- White Oak-wood (*Ardisia Sieboldii* Miq.)
- Yellow-wood (*Paralstonia clusiacea* Baill.)

NEW WOODY PLANTS FROM THE BONIN ISLANDS

ALFRED REHDER AND E. H. WILSON

Cyphokentia Savoryana, sp. nov. — *Ptychosperma elegans* Hattori in Jour. Coll. Sci. Tokyo, XXIII. art. 10, 22, 44, t. 2, fig. 1¹ (1908), non Blume.

Arbor ad 16 m. alta, trunco annulato laevi, circiter 0.5 circuitu, glabra paleis rufis foliorum erumpentium cito caducis exceptis. Folia paripinnata,

¹ The explanations to plates 2 and 4 have been interchanged.

circiter 12, erecto-patentia vel patentia, leviter arcuata, pinnis pendentibus, 1-3 m. longa; pinnae utrinque 50-60 (in planta juniore pauciora et partim confluentia), anguste lanceolata, ensiformia, apicem versus sensim angustata, 35-55 cm. longa et 2.5-3 cm. lata, basin versus leviter angustata et interstitiis 2-3 cm. latis separata, pleraque nervis 3 conspicuis instructa; petiolus 45-60 cm. longus, supra canaliculatus, inermis, basi in spatham circiter 70 cm. longam truncum amplectentem dilatatus. Flores monoeci, in spadice paniculato infrafoliaceo ante anthesin in spathis 2 concavis, dein deciduis circiter 70 cm. longis et una circiter 12 altera 20 cm. latis incluso, spiraliter dispositi satis approximati, bracteis latis brevibus abrupte acuminulatis ciliolatis apice longe sparse pilosis et bracteolis minutis suffulti, ut videtur terni, medius femineus, laterales masculi vel axium apicem versus omnes masculi (masculi in specimine praestante paucissimis exceptis decidui, ideoque spadix totus femineus videtur); panicula ampla, ramis patentibus axi angulato; axes tertii ordinis distiche dispositi, 30-40 cm. longi, compressi et leviter flexuosi, simplices vel inferiores bifurcati. Flores masculi: sepala 3, imbricata et plus minusve connata, triangulari-ovata, obtusiuscula, alato-carinata, scariosa, petalis duplo breviora; petala 3, valvata, oblongo-ovata, acutiuscula, 5 mm. longa; stamina 6, petalis paullo breviora, filamentis filiformibus basin versus paullo incrassatis, antheris oblongis 2 mm. longis sagittatis dorsifixis versatilibus; rudimentum ovarii filamentis paullo brevius, apice trifidum. Flores feminei: sepala imbricata, orbiculari-ovata, obtuse apiculata, 3 mm. longa, chartacea; petala imbricata, orbiculari-ovata, obtuse minute apiculata, 4 mm. longa, tenuiora; staminodia desunt; ovarium oblique ovoideum, stigmatibus 3 lateralibus, brevibus latisque, uni-ovulatum; ovulum parietale, pendulum. Inflorescentia fructifera pendula, satis dense fructibus instructa; fructus ovoidei, 1.2 cm. longi et 6-7 cm. diam., nigri, leviter pruinosi, infra apicem rudimento stigmatum valde laterali instructi et apiculati, basi perianthio persistente vix incrassato suffulti; pericarpium crassiusculum; semen ovoideum, facie ventrali leviter applanatum, 7 mm. longum et 5 mm. diam., fusco-brunneum, rapheos ramis a hilo ascendentibus et sparse anastomosantibus et ad situm embryonis convergentibus in testam impressis; albumen corneum, aequabile; embryo basilaris.

BONIN ISLANDS: Mukō-jima, sea-level to 250 m. alt., April 28, 1917, *E. H. Wilson* (No. 8334, type); Chichi-jima, sea-level to 250 m. alt., April 22, 1917, *E. H. Wilson* (No. 8212).

This graceful and handsome Palm agrees well in its generic characters with *Cyphokentia*, though it is geographically far removed from the other species of the genus which are all endemic to New Caledonia. It is still quite common in the more sheltered places on all the larger islands of the Bonin group and especially on Ani-jima. From a distance old trees resemble the Coconut in appearance with their spreading and arching leaves, but the leaves are smaller. It was the presence of this Palm and fresh water that made the Islands famous resorts for the old whaling ships. It is the "Arrack-tree" of Kaempfer and the "Areca oleracea" of Captain Beechey;

von Kittlitz refers to it (Twenty-four views Veget. Pacif. 48) as "the slender growing Areca." In the published accounts of the Islands this Palm is frequently mentioned; and since it proves to be peculiar to the Bonins, it appears to be most fitting that we should associate with it the name of one of the pioneers and chief founder of the settlement of Bonin Islands — Nathaniel Savory.

Ficus Iidaiana, sp. nov.

Arbor tenuis, sparse ramosa, ad 8 m. alta, trunco 0.3 m. circuitu; rami rubro-brunnei; juniores adpresse canescenti-pubescentes pilis longioribus villosis intermixtis. Folia membranacea, longe petiolata, ovata, subito breviter acuminata, basi rotundata vel subcordata, 7-15 cm. longa et 5-11 cm. lata, margine leviter undulata, supra saturate viridia, initio adpresse pubescentia, mox glaberrima, subtus pallide viridia, sparse et minute ad costam et venas densius puberula, utrinque nervis 5-7 erecto-patentibus secus marginem curvatis et anastomosantibus; petioli 3.5-7 cm. longi, minute adpresse pubescentes; stipulae membranaceae, ovato-lanceolatae, acuminatae, 1.5-2 cm. longae et 5-8 mm. latae. Receptacula axillaria, solitaria vel bina, pedunculo 1.5-3 cm. longo pubescenti, obovoidea vel ellipsoidea, 2-2.5 cm. longa et circiter 1.5 cm. diam., pleraque basi in stipitem ad 1 cm. longum contracta, minute adpresse pubescentia, basi bracteis 3 membranaceis late ovatis acutis 2-3.5 mm. longis instructa; flores masculi, feminei et galliferi in eodem receptaculo; flores masculi perianthio 4-fido; segmenta oblongo-lanceolata, obtusa vel acutiuscula, brunnea; stamina 2, raro 3 vel 1, segmentis breviora vel subaequilonga, antheris quadrangularelipsoideis quam filamenta longioribus vel rarius subaequilongis; flores feminei, ut videtur, immaturi, segmentis 3-4 anguste lanceolatis; stylus lateralis ovario brevior, stigmatibus obliquo acuto interdum leviter et inaequaliter bilobis; flores galliferi segmentis 3-4 inaequalibus lanceolatis ovarium late obovoideum paullo superantibus vel brevioribus, rudimento styli laterali. Fructus maturus ignotus.

BONIN ISLANDS: Haha-jima, Sekimonzan, alt. 300 m., April 26, 1917, *E. H. Wilson* (No. 8310).

A remarkably distinct species belonging to the section *Eusyke* and not closely related to any species known to us; well characterized by its leaves and by its relatively large and long-peduncled receptacle. It is apparently rare, for I saw it only on Sekimonzan.

It is named for Mr. S. Iida of Yokohama, Japan, my friend and genial traveling companion to the Bonin Islands. E. H. W.

Calpidia Nishimurae, comb. nov. — *Pisonia Nishimurae* Koidzumi in Tokyo Bot. Mag. xxxiii. 120 (1919).

BONIN ISLANDS: *M. Yai* and *S. Nishimura* (type), ex Koidzumi; Haha-jima, common, Sekimonzan, alt. 0-500 m., April 26, 1917, *E. H. Wilson* (No. 8311; tree 10-25 m. tall, 2-8 m. in girth).

As we are following Heimerl (in Oestr. Bot. Zeitschr. lxiii. 279 [1913]) in

considering *Calpidia* Du Petit-Thouars a distinct genus, we have to refer Koidzumi's species which is apparently very near *C. excelsa* (Bl.) Heimerl to that genus.

Evodia Kumagaiana, sp. nov. — *Erodia triphylla* Hattori in Jour. Coll. Sci. Tokyo, xxiii. art. 10, 28 (1908), non De Candolle.

Frutex 2-4-metralis, ramosissimus, glaber, ramis crassis subteretibus, cortice laevi rubro-brunneo striis pallide cinereis notato, ligno denso. Folia trifoliolata, coriacea, persistentia; foliola petiolulata petiolulis 0.5-2.5 cm. longis, medio lateralibus paullo longiore, supra canaliculatis, obovata vel elliptica vel oblongo-obovata, apice rotundata et saepissime emarginata, basi cuneata et saepe obliqua, 3-10, pleraque 6-9 cm. longa, et 1.5-4.5 cm. lata, integra, supra luteo-viridia, lucida, subtus opaca, minute glanduloso-punctulata, nervis utrinsecus 7-10 sub angulo fere recto divergentibus; petioli 2-7 cm. longi, subteretes. Inflorescentia axillaris, paniculata, pedunculo crasso 0.5-2 cm. longo glabrescenti incluso 2-6 cm. longa et 2-3 cm. lata, axibus crassiusculis floribusque tomento velutino brevi cinereo-flavescente obtectis; flores 4-meri, unisexuales, albidii, circiter 5 mm. diam., brevissime pedicellati, bracteis bracteolisque triangularibus acutiusculis minutis suffulti. Flores masculi: sepala semiorbicularia, 1 mm. longa et 1.5 mm. lata, basi decurrentia; petala patentia, ovata, 3 mm. longa, acutiuscula, extus velutina, intus fere glabra, glanduloso-punctulata; stamina erecta, petala aequantia, filamentis subulatis glabris, antheris subglobois; rudimentum ovarii dense tomento velutino fusco-flavescenti obtectum. Flores feminei (deflorati tantum visi) similes, sed sepala ovata, acutiuscula, vix 1 mm. longa et paullo angustioribus; staminodia pistillum superantia, antheris sterilibus; pistillum dense velutinum, stylo brevi piloso, stigmatibus capitato. Fructus desideratur.

BONIN ISLANDS: Ani-jima, thickets, alt. 100-200 m.. May 3, 1917, *E. H. Wilson* (No. 8370).

This species belongs to the section *Lepta*, subsect. *Trifoliolatae* Engl. and has been confused by Japanese botanists with *E. triphylla* De Candolle which, however, is easily distinguished by its thin acuminate leaves and glabrous ovary; from the species with coriaceous leaflets known to us, as *E. acuminata* Merrill, *E. benguetensis* Elmer, *E. Kingii* Engler, *E. pachyphylla* King, *E. retusa* Merrill and *E. robusta* Hooker f., it differs in its emarginate leaflets, small paniculate inflorescence, velutinous petals and in its densely tomentose ovary.

Evodia Kumagaiana is fairly common on Ani-jima, but I did not see it elsewhere. It is named for Mr. Y. Kumagai, Okitsu Experimental Station, Shizuoka-ken, who was detailed by the Japanese Government to accompany me to the Bonin Islands, in appreciation of many valued services.

E. H. W.

Zanthoxylum ailanthoides Sieb. & Zucc. var. *inerme*, var. nov. — *Xanthoxylum ailanthoides* Hattori in Jour. Coll. Sci. Tokyo, xxiii. art. 10, 28 (1908), non Siebold & Zuccarini.

A typo recedit defectu aculearum, omnibus partibus plantae aculeis omnino destitutis.

BONIN ISLANDS: Haha-jima, woods and thickets, alt. 100–400 m., April 29, 1917, E. H. Wilson (No. 8265, type; tree 8–16 m. tall; leaves and old fruits); Chichi-jima, without precise locality *H. Otomo* (flowers).

By Japanese botanists this tree has been referred to *Zanthoxylum ailanthoides* Sieb. & Zucc. which, however, is easily distinguished from it by the prickles on the trunk, the branches, and often on the leaf-rhachis. The Bonin form is without prickles on any of its parts, but in all other characters it agrees perfectly with the typical form as we know it from Japan and Korea. It is common on all the larger islands and emits a very strong rue-like odor. The Bonin Islanders call it Poison-wood tree and use its wood in making the hulls of their canoes.

Symplocos Otomoi, sp. nov.

Frutex glaberrimus, sepalis et petalis ciliolatis exceptis; rami juniores crassiusculi alato-angulati, flavidi, vetustiores acute angulati. Folia crasse coriacea, ad tertium annum persistentia, breviter petiolata, elliptica vel ovato-elliptica, apice rotundata vel retusa, basi late cuneata, 2–4 cm. longa et 1–2.5 cm. lata, margine integra, valde revoluta, supra laete luteo-viridia, nitentia, rugosa, subtus pallidiora, costa supra impressa, subtus elevata, nervis utrinsecus circiter 6, supra impressis, subtus obsolete; petioli 2.5 cm. longi, alati. Flores 0.8–1 cm. diam., subsessiles, in racemis axillaribus vix 1 cm. longis densis circiter 5-floris; bracteae ovatae, 1.5–3 mm. longae; calyx 3–3.5 cm. longus, lobis late ovatis vel semiorbicularibus rotundatis circiter 2 mm. longis et latis ciliolatis in tubum brevem vix aequilongum connatis; petala calycem duplo superantia, elliptica, leviter concava, obtusa, 5–6 mm. longa et 3–3.5 mm. lata, ciliolata; stamina manifeste pentadelphica, circiter 75, longiora petala subaequantia, filamentis filiformibus glabris, antheris suborbicularibus; stylus brevis, 1.5 mm. longus, glaber, sulcatus, stigmatibus 3 parvis leviter divergentibus; ovarium triloculare, apice leviter pubescens.

BONIN ISLANDS: Chichi-jima, without precise locality, *H. Otomo*.

A very distinct species characterized by its small crowded rugose obtuse or emarginate leaves and winged shoots. It seems most closely related to *S. crassifolia* Benth. and to *S. lucida* Sieb. & Zucc., but these are both easily distinguished by the acute or acuminate leaves smooth above, serrate in *S. lucida*, and by the stamens exceeding the petals and fewer, 30–60, in number, and by the less winged shoots.

I take pleasure in associating this new species with Mr. Hidemasa Otomo, Forestry officer for the Bonin Islands, to whom I am indebted for the specimen and whose knowledge of the flora and energetic help did so much toward making my visit to the Bonin Islands a pleasant and successful one.

E. H. W.

Symplocos boninensis, sp. nov.

Arbor 3–6-metralis, trunco 0.3–0.5 m. circuitu, ramosissima, omnino

glabra, pilis paucis mox deciduis in apice foliorum et in apice gemmarum et florum partibus ciliolatis exceptis; rami hornotini praesertim apicem versus angulati, annotini teretes, ut hornotini plerumque virides, vetustiores brunneo-fusci. Folia coriacea, per duos vel tres annos persistentia, longe petiolata, elliptica vel elliptico-ovata vel oblongo-ovata, rarius obovata, rotundata vel emarginata, rarius obtusiuscula et mucronulata, basi cuneata, 1.5–9 cm., pleraque 5–8 cm. longa et 0.5–4.5, pleraque 2–4 cm. lata, margine leviter undulata et glandulis minutis remotis caducis instructa, supra luteo-viridia, nitentia, subtus paullo pallidiora et opaca, nervis utrinsecus 5–6 ut costa subtus et supra leviter elevatis, venulis obsoletis; petioli crassiusculi, 1.5–3 cm. longi, supra applanati, apicem versus lamina decurrente marginata. Flores albi, axillares, 1–3, 0.8–1 cm. diam.; pedunculus floris centralis 3–5 mm. longus, bracteis pluribus rotundatis 2.5–3.5 mm. longis viridibus minute puberulis ciliolatis obtectus, plerumque 1 vel 2 flores laterales gerens; calyx 4–5 mm. longus, lobis ovatis ciliolatis quam tubus longioribus; petala obovata, concava, 5 mm. longa et 2.5–3 mm. lata, ciliolata; stamina pentadelphica, 90–100, longiora petalis paullo longiora, filamentis glabris; stylus 4 mm. longus, triangularis, stigmatibus 3 minutis; ovarium 3-loculare, apice pubescens. Fructus solitarius, oblongo-ellipsoideus, circiter 1.6 cm. longus, 1 cm. diam., calyce persistente coronatus, pedunculo brevi dense bracteato suffultus.

BONIN ISLANDS: Mukō-jima, woods, alt. 50–100 m., April 28, 1917, *E. H. Wilson* (No. 8336, type); Chichi-jima, Hatsune-yama, *H. Otomo*.

A well-marked species characterized by its leaves, the 1–3-flowered inflorescence and by the large fruit. It appears related to *S. lucida* Sieb. & Zucc. which has smaller serrate leaves, shorter petioles, fascicled flowers and smaller fruit. This new species is common on Mukō-jima, but Wilson did not see it elsewhere. The Chichi-jima specimen from the herbarium of Mr. Otomo looks quite different at first sight with its slenderer branchlets, smaller obovate to oblong-obovate leaves, but on critical examination we are satisfied that it belongs to the same species and is from a weak branch.

Lobelia boninensis Koidzumi in Matsumura Icon. Pl. Koisikav. II. 19, t. 94 (1914).

Suffrutex 1–2 m. altus, glaber, monocarpicus, caule crasso glabro circiter 3 cm. diam., in parte superiore medulla ampla alba repleto, in parte inferiore fistuloso, cortice albido foliorum cicatricibus triangularibus vel semi-orbicularibus conspicuis 0.8–1.4 cm. diam. notato. Folia numerosissima, basalia conferta oblanceolata-oblonga vel lanceolato-oblonga, subito acutata, 8–20 cm. longa et 2–3.5 cm. lata, basi in petiolum circiter 1 cm. longum alato-marginatum contracta, remote et sparse crenato-serrata, supra laete viridia, nitentia, subtus pallidiora, glabra, utrinque nervis 12–18 supra leviter impressis subtus elevatis ante marginem anastomosantibus, caulina sparsa, ligulata, 30–35 cm. longa et 3–3.5 cm. lata, sensim in petiolum alatum angustata, nervis fere duplo numerosioribus, ceterum ut basalia. Inflorescentia terminalis paniculata pubescens, e racemis 40–50 cm. longis compo-

sita; flores non visi. Capsula ovoidea vel ellipsoidea 1.4 cm. longa et 5 mm. lata, pedicello circiter 1 cm. longo pubescente erecto, 10-costata costis anguste alatis, calycis lobis coronata.

BONIN ISLANDS: Mukō-jima, sea-level to 200 m. alt., April 28, 1917, *E. H. Wilson* (No. 8343, type); Chichi-jima, cliffs, sea-level to 200 m. alt., common, April 23 1917, *E. H. Wilson* (No. 8277).

This very interesting addition to the flora of eastern Asia is fairly common in open grassy places on all the islands which Wilson visited, and it seems strange that it should have remained without a name. It had been apparently first found by C. Wright according to a statement by Hillebrand in his *Flora of the Hawaiian Islands*, p. 237 (1888), who mentions under *Lobelia Gaudichaudii* De Candolle a specimen collected by Wright on the Loo-choo Islands (apparently a mistake for Bonin Islands, for there is no such *Lobelia* known from the Liukiu Islands) and says that it resembles the present species (*L. Gaudichaudii*) greatly and that it is preserved in the Harvard Herbarium, but there is now no *Lobelia* from the Bonin Islands in the Gray Herbarium and none is mentioned in Dr. Gray's manuscript list of Bonin and Loo-choo plants. Our new species is undoubtedly near *L. Gaudichaudii*, but that species has sessile leaves with a broad base and a conspicuous row of resinous glands on the margins.

At the last moment, when this article was already in press, we discovered that Koidzumi had described and figured this *Lobelia* which we had supposed to be an undescribed species in Matsumura's *Icones Plantarum Koisikavenses*.

NEW SPECIES, VARIETIES AND COMBINATIONS FROM THE HERBARIUM AND THE COLLECTIONS OF THE ARNOLD ARBORETUM¹

ALFRED REHDER

FAGACEAE

Castanopsis Spach

In the limitation of this genus I am following Schottky and unite the section *Chlamydoalanus* Endlicher (sub *Quercu*; Oersted sub *Pasania*) with *Castanopsis*. From *Castanea* the genus is easily distinguished by the evergreen often entire leaves. From *Lithocarpus* it differs in the thin cupula usually enclosing the nut entirely and splitting at maturity to liberate it; the cupula is furnished with spines or tubercles arranged in usually oblique zones, it is never covered by closely imbricate scales nor by concentric distinct rings; the number of flowers varies from 3-1 in a cupula. The leaves are usually distichously arranged.

Castanopsis acuminatissima, comb. nov. — *Quercus lineata* Miquel, Pl. Junghuhn. i. 10 (1850), non Blume. — *Castanea acuminatissima* Blume, Mus. Bot. Lugd.-Bat. i. 283 (1850). — *Quercus faqiformis* Junghuhn in

¹ Continued from p. 60.

Bonplandia vi. 82, fig. (1858).¹ — *Quercus Junghuhnii* Miquel, F. Ind. Bat. i. pt. i. 853 (1858). — Oudemans in Verh. Akad. Wet. Amsterd. xi. No. 3, 15, t. 9 (Annot. Crit. Cupulif. Jav.) (1865). — King in Ann. Bot. Gard. Calcutta, ii. 78, t. 73 (1889). — *Quercus acuminatissima* A. De Candolle, Prodr. xvi. pt. ii. 102 (1864). — *Pasania acuminatissima* Oersted in Naturh. For. Vidensk. Meddel. xviii. 84 (1866).

JAVA.

Castanopsis Blumeana, comb. nov. — *Quercus Blumeana* Korthals in Verh. Nat. Geschied. Bot. 208, t. 44 (1842). — King in Ann. Bot. Calcutta, ii. 75, t. 69B (1889). — *Cyclobalanus Blumeana* Oersted in Naturh. For. Vidensk. Meddel. xviii. 81 (1866). — *Synaedrys Blumeana* Koidzumi in Tokyo Bot. Mag. xxx. 186 (1916).

SUMATRA, BORNEO.

Castanopsis encleisocarpa, comb. nov. — *Quercus encleisocarpa* Korthals in Verh. Nat. Geschied. Bot. 208, t. 45 (1842). — King in Ann. Bot. Gard. Calcutta, ii. 80, t. 75, figs. 1-3 (1889). — *Cyclobalanus encleistocarpa* [sic] Oersted in Naturh. For. Vidensk. Meddel. xviii. 81 (1866). — *Synaedrys encleisocarpa* Koidzumi in Tokyo Bot. Mag. xxx. 186 (1916).

SUMATRA.

Castanopsis reflexa, comb. nov. — *Quercus reflexa* King in Ann. Bot. Gard. Calcutta, ii. 78, t. 72 (1889). — *Synaedrys reflexa* Koidzumi in Tokyo Bot. Mag. xxx. 187 (1916).

BORNEO.

Lithocarpus Bl.

Blume's name *Lithocarpus* of 1825 must replace *Synaedrys* Lindley of 1836 taken up by Koidzumi and *Pasania* Oersted of 1866 which has been so far the generally accepted name for the genus. For citations of literature and further remarks see foot-note in Sargent, Pl. Wilson. iii. 205 (1916).

Lithocarpus acuminata, comb. nov. — *Quercus acuminata* Roxburgh, Fl. Ind. ed. 2, iii. 636 (1832). — Wight, Icon. i. t. 221, figs. 6-9 (1840). — King in Ann. Bot. Gard. Calcutta, ii. 41, t. 32B (1889). — *Quercus fenestrata* var. *acuminata* Wenzig in Jahrb. Bot. Gard. Berlin, iv. 224 (1886). — *Pasania acuminata* Oersted in Naturh. For. Vidensk. Meddel. xvi. 83 (1866). — *Synaedrys acuminata* Koidzumi in Tokyo Bot. Mag. xxx. 193 (1916).

MALESIA.

Lithocarpus amygdalifolia, comb. nov. — *Quercus amygdalifolia* Skan in Jour. Linn. Soc. xxvi. 506 (1899). — *Pasania amygdalifolia* Schottky in Bot. Jahrb. xlvii. 660 (1912). — *Synaedrys amygdalina* (sic) Koidzumi in Tokyo Bot. Mag. 188 (1916).

CHINA.

¹ Junghuhn's article is stated to be a translation from the *Natuurk. Tijdschr. Ned.-Ind.* ser. 3, iv. of 1857. but the Dutch original article was not published until the following year (in ser. 4, i. 23-138) and contains no reference to *Q. fagiformis*, the paragraph of the German translation from "Hier besteht der Wald" to "*Q. fagiformis*," including the figure and foot-note, being entirely omitted from the Dutch article.

Lithocarpus apoensis, comb. nov. — *Quercus apoensis* Elmer in Leaflet. Philip. Bot. III. 945 (1910).

PHILIPPINE ISLANDS.

Lithocarpus attenuata, comb. nov. — *Quercus Eyrei* Hance in Jour. Bot. XXII. 229 (1884), non Champion. — *Quercus attenuata* Skan in Jour. Linn. Soc. XXVI. 506 (1899). — *Pasania attenuata* Schottky in Bot. Jahrb. XLVII. 675 (1912).

CHINA: Hongkong.

Lithocarpus Bennettii, comb. nov. — *Quercus Bennettii* Miquel, Fl. Ind. Bat. I. pt. I. 857 (1856). — King in Ann. Bot. Gard. Calcutta, II. 64, t. 58a (1889). — Merrill in Philip. Jour. Sci. III. Bot. 328 (1908). — *Quercus Llanosii* Fernandez-Villar, Nov. App. Fl. Filip. 208 (1883), non A. De Candolle. — *Quercus Wenzigiana* Merrill in Philip. Jour. Sci. I. suppl. 41 (1906), non King. — *Synaedrys Bennettii* Koidzumi in Tokyo Bot. Mag. XXX. 190 (1916).

PHILIPPINE ISLANDS.

Lithocarpus brevipendula, comb. nov. — *Quercus brevipendula* Skan in Jour. Linn. Soc. XXVI. 508 (1899). — *Pasania brevipendula* Schottky in Bot. Jahrb. XLVII. 666 (1912). — *Synaedrys brevipendula* Koidzumi in Tokyo Bot. Mag. XXX. 194 (1916).

FORMOSA.

Lithocarpus Carolinae, comb. nov. — *Quercus Carolinae* Skan in Jour. Linn. Soc. XXXV. 518 (1903). — *Pasania Carolinae* Schottky in Bot. Jahrb. XLVII. 673 (1912). — *Synaedrys Carolinae* Koidzumi in Tokyo Bot. Mag. XXX. 194 (1916).

CHINA: Yunnan.

Lithocarpus cathayana, comb. nov. — *Quercus cathayana* Seemen in Fedde, Rep. Spec. Nov. III. 53 (1906). — *Pasania cathayana* Schottky in Bot. Jahrb. XLVII. 663 (1912). — *Synaedrys cathayana* Koidzumi in Tokyo Bot. Mag. XXX. 188 (1916).

CHINA.

Lithocarpus caudatifolia, comb. nov. — *Quercus caudatifolia* Merrill in Philip. Jour. Sci. III. Bot. 324 (1908). — *Synaedrys caudatifolia* Koidzumi in Tokyo Bot. Mag. XXX. 190 (1916).

PHILIPPINE ISLANDS.

Lithocarpus celebica, comb. nov. — *Quercus celebica* Miquel in Ann. Mus. Bot. Lugd.-Bat. I. 110 (1863). — *Cyclobalanus celebica* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 81 (1866). — *Synaedrys celebica* Koidzumi in Tokyo Bot. Mag. XXX. 194 (1916).

CELEBES.

Lithocarpus clathrata, comb. nov. — *Quercus clathrata* Seemen in Bot. Jahrb. XXVII. beibl. LXIV. 15 (1900). — *Synaedrys clathrata* Koidzumi in Tokyo Bot. Mag. XXX. 190 (1916).

JAVA.

Lithocarpus conocarpa, comb. nov. — *Quercus conocarpa* Oudemans in Versl. Akad. Wetensch. Amsterd. Afd. Natuurk. XII. 206 (1861); in

Verh. Akad. Wet. Amsterd. xi. No. 3, 18, t. 10 (Annot. Cupulif. Jav.) (1865). — King in Ann. Bot. Gard. Calcutta, ii. 61, t. 56a (1889). — *Cyclobalanus conocarpa* Oersted in Naturh. For. Vidensk. Meddel. xviii. 81 (1866). — *Synaedrys conocarpa* Koidzumi in Tokyo Bot. Mag. xxx. 191 (1916).

JAVA.

Lithocarpus cooperta, comb. nov. — *Castanea cooperta* Oersted in Vidensk. Selsk. Naturvid. Skrift. ser. 5, ix. 379 (1873). — *Quercus cooperta* Blanco, Fl. Filip. ed. 2, 503 (1845). — *Castanopsis costata* Fernandez-Villar, Nov. App. Fl. Filip. 209 (1883), non A. De Candolle. — *Quercus Fernandezii* Vidal, Sinops. Atl. xli. t. 92, fig. E (1883). — *Synaedrys cooperta* Koidzumi in Tokyo Bot. Mag. xxx. 186 (1916).

PHILIPPINE ISLANDS.

Lithocarpus Copelandii, comb. nov. — *Quercus Copelandii* Elmer in Leaf. Philip. Bot. VI. 1984 (1913).

PHILIPPINE ISLANDS.

Lithocarpus costata, comb. nov. — *Quercus costata* Blume, Fl. Jav. Cupulif. 25, t. 13 (1828-50). — King in Ann. Bot. Gard. Calcutta, ii. 82, t. 76a (1889). — *Lithocarpus scutigera* Oudemans in Meded. Akad. Amsterd. Afd. Natuurk. xii. 207 (1861); in Verh. Akad. Wet. Amsterd. xi., No. 3, 20, t. 12 (Annot. Cupulif. Jav.) (1865). — *Cyclobalanus costata* Oersted in Naturh. For. Vidensk. Meddel. xviii. 81, t. 1-2, fig. 14 (1866). — Koorders & Valeton, Bijdr. Jaav. Booms. x. 60 (1904). — *Synaedrys costata* Koidzumi in Tokyo Bot. Mag. xxx. 188 (1916).

MALESIA.

Lithocarpus Curranii, comb. nov. — *Quercus curranii* Merrill in Philip. Jour. Sci. iii. Bot. 329 (1908). — *Synaedrys Curranii* Koidzumi in Tokyo Bot. Mag. xxx. 189 (1916).

PHILIPPINE ISLANDS.

Lithocarpus crassinervia, comb. nov. — *Quercus crassinervia* Blume, Mus. Bot. Lugd.-Bat. i. 292 (1850). — *Quercus pseudo-molucca* Bl. β . *crassinervia* Miquel, Fl. Ind. Bat. i. pt. i. 849 (1855). — *Pasania crassinervia* Oersted in Naturh. For. Vidensk. Meddel. xviii. 84 (1866). — *Synaedrys crassinervia* Koidzumi in Tokyo Bot. Mag. xxx. 194 (1891).

JAVA.

Lithocarpus cyrtorhyncha, comb. nov. — *Quercus cyrtorhyncha* Miquel, Fl. Ned. Ind. Suppl. 350 (1840). — King in Ann. Bot. Gard. Calcutta, ii. 66b (1889). — *Synaedrys cyrtorhyncha* Koidzumi in Tokyo Bot. Mag. xxx. 191 (1916).

SUMATRA.

Lithocarpus dasystachya, comb. nov. — *Quercus dasystachya* Miquel in Ann. Mus. Bot. Lugd.-Bat. i. 221 (1864-65). — *Synaedrys dasystachya* Koidzumi in Tokyo Bot. Mag. xxx. 194 (1916).

BORNEO.

Lithocarpus dealbata, comb. nov. — *Quercus dealbata* Hooker f. & Thomson apud A. De Candolle, Prodr. xvi. pt. ii. 85 (1864). — King in

Ann. Bot. Gard. Calcutta, II. 46, t. 40, figs. 1-4 (1889). — *Pasania dealbata* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 84 (1866). — *Quercus fenestrata* Roxb. var. *a. dealbata* Wenzig in Jahrb. Bot. Gard. Berlin, IV. 224 (1886). — *Synaedrys dealbata* Koidzumi in Tokyo Bot. Mag. XXX. 194 (1916).

INDIA: Nepal.

Lithocarpus densiflora Rehd. f. *lanceolata*, comb. nov. — *Pasania densiflora* f. *lanceolata* Jepson, Fl. Calif. 362 (1909); Silv. Calif. 237 (1910).

CALIFORNIA: Mendocino and Del Norte Counties.

Lithocarpus densiflora var. *montana*, comb. nov. — *Quercus echinoides* R. Brown Campst. in Ann. Mag. Nat. Hist. ser. 4, VII. 251 (1871). — *Quercus densiflora* Greene, West Am. Oaks, t. 24 (1889), non Hooker & Arnott. — *Quercus densiflora* var. *montana* Mayr, Wald. Nordam, 264, t. 2, fig. (1890). — *Quercus densiflora* var. *echinoides* Sargent, Silv. N. Am. VIII. 183, t. 488, fig. 9 (1895). — *Pasania montana* Mayr, Wald- & Parkb. 487, t. 14, fig. (1906). — *Pasania densiflora* var. *echinoides* Jepson, Fl. Calif. 363 (1909); Silv. Calif. 237 (1910).

OREGON, CALIFORNIA.

Lithocarpus dolichocarpa, comb. nov. — *Quercus dolichocarpa* Seemen in Bot. Jahrb. XXVII. beibl. LXIV. 14 (1900). — *Synaedrys dolichocarpa* Koidzumi in Tokyo Bot. Mag. XXX. 191 (1916).

SUMATRA.

Lithocarpus edulis, comb. nov. — *Quercus glabra* Siebold & Zuccarini, Fl. Jap. I. 170, t. 89 (1841), non Thunberg. — Shirasawa, Icon. Ess. For. Jap. I. t. 32, figs. 14-24 (1900). — *Quercus edulis* Makino in Tokyo Bot. Mag. XI. (38) (1897). — *Pasania edulis* Makino, l. c. (39) (1897). — *Synaedrys edulis* Koidzumi in Tokyo Bot. Mag. XXX. (28), 191 (1916). — *Pasania glabra* Oersted in Naturh. Forh. Vidensk. Meddel. XVIII. 83 (1866), pro parte, quoad cit. Sieb. & Zucc. — Schottky in Bot. Jahrb. XLVII. 669 (1912). — *Lithocarpus glabra* Rehder in Bailey, Stand. Cycl. Hort. VI. 3569 (1917), pro parte, quoad descriptionem.

JAPAN.

This species had been erroneously identified by Siebold & Zuccarini with *Q. glabra* Thunberg and this identification has been accepted by all subsequent botanists until Makino in 1897 showed that Thunberg's name properly belongs to the species described as *Q. thalassica* by Hance. See note under *Lithocarpus glabra*.

Lithocarpus Elizabethae, comb. nov. — *Quercus Elizabethae* Tutchet in Jour. Bot. XLIX. 273 (1911). — *Pasania Elizabethae* Schottky in Bot. Jahrb. XLVII. 685 (1912).

CHINA: Hongkong.

Tutchet places this species under the section *Claymlobalanus*, but according to the specimens before me it belongs into the affinity of *L. dealbata* and *L. fenestrata*.

Lithocarpus Eyrei, comb. nov. — *Quercus Eyrei* Champion apud Benth. in Hooker Jour. Bot. VI. 114 (1854).

CHINA: Hongkong.

Lithocarpus fenestrata, comb. nov. — *Quercus fenestrata*, Roxburgh, Fl. Ind. ed. 2, III. 633 (1832). — Wight, Icon. t. 219 (1840). — King in Ann. Bot. Gard. Calcutta, II. 45, t. 39 (1889). — *Quercus callicarpifolia* Griffith, Itin. Not. II. 87, No. 1268 (1848), pro parte. — *Pasania fenestrata* Oersted, in Naturh. For. Vidensk. Meddel. XVIII. 84 (1866). — *Synaedrys fenestrata* Koidzumi in Tokyo Bot. Mag. xxx. 195 (1916).

HIMALAYAS.

Lithocarpus formosana, comb. nov. — *Quercus formosana* Skan in Jour. Linn. Soc. XXVI. 513 (1899). — *Pasania formosana* Schottky in Bot. Jahrb. XLVII. 670 (1912). — *Synaedrys formosana* Koidzumi in Tokyo Bot. Mag. xxx. 195 (1916).

FORMOSA.

Lithocarpus glabra Rehder in Bailey, Stand. Cycl. Hort. vi. 3569 (1917), ex parte, quoad synonym. Thunberg. — *Quercus glabra* Thunberg, Fl. Jap. 175 (1784); Icon. Pl. Jap. iv. t. 5 (1802). — Willdenow, Spec. Pl. iv. 427 (1805). — Makino in Tokyo Bot. Mag. XI. (37) (1897). — *Quercus thalassica* Hance in Hooker Kew Jour. I. 176 (1849). — Shirasawa, Icon. Ess. For. Jap. I. t. 33 (1900). — *Quercus inversa* Lindley & Paxton, Flow. Gard. I. 58, fig. 36 (1850). — Seemann, Bot. Voy. Herald, 414, t. 88 (1852-57). — *Quercus Sieboldiana* Blume, Mus. Bot. Lugd.-Bat. I. 290 (1850). — *Quercus reversa* Benthham in Hooker Kew Jour. VI. 112 (1854). — *Pasania glabra*, Oersted in Naturh. For. Vidensk. Meddel. XVIII. 83 (1866), ex parte, excl. syn. Sieb. & Zucc. — *Pasania thalassica* Oersted, l. c. (1866). — *Synaedrys glabra* Koidzumi in Tokyo Bot. Mag. xxx. (28), 195 (1916). — *Lithocarpus thalassica* Rehder in Bailey, Stand. Cycl. Hort. VI. 3569 (1917).

JAPAN.

Siebold & Zuccarini's identification of Thunberg's *Quercus glabra* with another Japanese species enumerated above as *Q. edulis*, had unfortunately been accepted by all later botanists, until Makino in 1897 pointed out that *Q. glabra* Thunberg is identical with *Q. thalassica* Hance and that *Q. glabra* Sieb. & Zucc. is a species hitherto unnamed for which he proposed the name *Q. edulis* or *Pasania edulis*. A careful comparison of herbarium material with Thunberg's description and with the figure in his Icones and also with an excellent photograph of the type specimen kindly sent to me by Professor O. Juel of Upsala has convinced me that Makino is right. Thunberg's description of the leaves as "utrinque glabra" has apparently misled botanists, as the leaves are distinctly pubescent only when young, while at maturity the underside is covered with a close scurfy tomentum which to the naked eye does not appear as tomentum, but the words "oblongo-lanceolata, cuspidata" fit only *Q. thalassica* Hance, and so does the description of the inflorescence as "spicae florum terminales . . . tomentosae," for in *L. edulis* the staminate spikes are axillary and glabrous. Moreover Thunberg's figure which is a fairly faithful representation of his type specimen agrees exactly with specimens of *Q. thalassica* before me and has little resemblance to *L. edulis*.

Lithocarpus Hancei, comb. nov. — *Quercus Hancei* Benth. in Fl. Hongkong. 322 (1861). — *Pasania Hancei* Schottky in Bot. Jahrb. XLVII. 669 (1912). — *Synaedrys Hancei* Koidzumi in Tokyo Bot. Mag. xxx. 191 (1916).

CHINA: Hongkong.

Lithocarpus Harlandii, comb. nov. — *Quercus Harlandii* Hance in Walper's Ann. III. 382 (1852). — *Pasania Harlandii* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 83 (1866). — *Synaedrys Harlandii* Koidzumi in Tokyo Bot. Mag. xxx. 191 (1916).

CHINA: Hongkong.

Lithocarpus heliciformis, comb. nov. — *Quercus heliciformis* Seemen in Bot. Jahrb. XXVII. beibl. LXIV. 15 (1900). — *Synaedrys heliciformis* Koidzumi in Tokyo Bot. Mag. xxx. 191 (1916).

JAVA.

Lithocarpus hystrix, comb. nov. — *Quercus hystrix* Korthals in Verh. Nat. Geschied. Bot. 201, t. 43 (1842). — King in Ann. Bot. Gard. Calcutta, II. 54, t. 50 (1889). — *Quercus Korthalsii* Bl. var. *hystrix* Blume, Mus. Bot. Lugd.-Bat. I. 293 (1850). — *Cyclobalanus hystrix* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 81 (1866). — *Synaedrys hystrix* Koidzumi in Tokyo Bot. Mag. xxx. 195 (1916).

MALESIA.

Lithocarpus induta, comb. nov. — *Quercus induta* Blume in Verh. Bat. Genoot. Wetensch. IX. 220 (1823); Fl. Jav. Cupulif. 23, t. 12 (1828-51). — King in Ann. Bot. Gard. Calcutta, II. 55, t. 51 (1889). — *Cyclobalanus induta* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 80, t. 1-2, fig. 17 (1866). — *Synaedrys induta* Koidzumi in Tokyo Bot. Mag. xxx. 195 (1916).

JAVA.

Lithocarpus Irwinii, comb. nov. — *Quercus Irwinii* Hance in Ann. Sci. Nat. ser. 4, XVIII. 229 (1862). — *Pasania Irwinii* Oersted in Naturh. For. Vidensk. For. Meddel. XVIII. 83 (1866). — *Synaedrys Irwinii* Koidzumi in Tokyo Bot. Mag. xxx. 195 (1916).

CHINA: Kwangtung, Hongkong.

Lithocarpus iteaphylla, comb. nov. — *Quercus iteaphylla* Hance in Jour. Bot. XXII. 229 (1884). — *Pasania iteaphylla* Schottky in Bot. Jahrb. XLVII. 669 (1912). — *Synaedrys iteaphylla* Koidzumi in Tokyo Bot. Mag. xxx. 196 (1916).

CHINA: Hongkong.

Lithocarpus Jordanae, comb. nov. — *Quercus Jordanae* Laguna, Apunt. Nuev. Roble Filip. 7, t. (1875). — *Quercus Vidalii* Fernandez-Villar, Nov. App. Fl. Filip. 209 (1883). — Vidal, Sin. Pl. Leñ. Filip. Atl. t. XLI. t. 92, fig. B (1883). — *Quercus caraballoana* Fernandez-Villar. l. c. 209 (1883). — *Quercus Havilandii* Seemen in Perkins, Fragm. Fl. Philip. 42 (1904), non Stapf. — *Quercus sundaica* Merrill in Philip. Jour. Sci. I. suppl. 41 (1906), non Blume. — *Synaedrys Jordanae* Koidzumi in Tokyo Bot. Mag. xxx. 196 (1916).

PHILIPPINE ISLANDS.

Lithocarpus lamponga, comb. nov. — *Quercus lamponga* Miquel, Fl. Ind. Bat. Suppl. 347 (1860). — King in Ann. Bot. Gard. Calcutta, II. 53, t. 49 (1889). — *Cyclobalanus lamponga* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 81 (1866). — *Quercus brevi-petiolata* Scheffer, Obs. Phyt. II. 47 (1869). — *Synaedrys lamponga* Koidzumi in Tokyo Bot. Mag. XXX. 196 (1916).

MALESIA.

Lithocarpus lappacea, comb. nov. — *Quercus lappacea* Roxburgh, Fl. Ind. ed. 2, III. 637 (1832). — Wight, Icon. I. t. 220 (1840). — King in Ann. Bot. Gard. Calcutta, II. 41, t. 33 (1889). — *Quercus hirsuta* Lindley in Wallich, Cat. no. 3734 (1829), nomen. — *Quercus Mackiana* Hooker, Icon. III. t. 224 (1840). — *Pasania lappacea* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 84 (1866). — *Synaedrys lappacea* Koidzumi in Tokyo Bot. Mag. XXX. 196 (1916).

HIMALAYAS.

Lithocarpus lipacon, comb. nov. — *Quercus lipacon* Elmer in Leaflet. Philip. Bot. VI. 1983 (1913).

PHILIPPINE ISLANDS.

Lithocarpus Llanosii, comb. nov. — *Quercus Llanosii* A. De Candolle, Prodr. XVI. pt. II. 97 (1864), excl. syn. Blancoi. — *Cyclobalanus Llanosii* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 80 (1866). — *Quercus campanoana* Vidal, Sin. Pl. Leñ. Filip. Atl. XLI. t. 92, f. D (1883). — *Quercus sundaica* Fernandez-Villar, Nov. App. Fl. Filip. 207 (1883), non Blume. — *Synaedrys Llanosii* Koidzumi in Tokyo Bot. Mag. XXX. 196 (1916).

PHILIPPINE ISLANDS.

Lithocarpus lucida, comb. nov. — *Quercus cuneata* Herb. Roxburgh apud Wallich, Cat. no. 3732 (1829), nomen, non Wangenheim. — A. De Candolle, Prodr. XVI. pt. II. 108 (1864), nomen. — *Quercus lucida* Roxburgh, Fl. Ind. ed. 2, III. 635 (1832). — King in Ann. Bot. Gard. Calcutta, II. 69, t. 64 (1889). — *Synaedrys lucida* Koidzumi in Tokyo Bot. Mag. XXX. 192 (1916).

MALAY PENINSULA.

Lithocarpus Maingayi, comb. nov. — *Quercus Maingayi* Benth in Hooker, Icon. XIV. t. 1314 (1880). — King in Ann. Bot. Gard. Calcutta, II. 82, t. 77 (1889). — *Synaedrys Maingayi* Koidzumi in Tokyo Bot. Mag. XXX. 189 (1916).

MALAY PENINSULA.

Lithocarpus Mairei, comb. nov. — *Pasania Mairei* Schottky in Bot. Jahrb. XLVII. 665 (1912). — *Synaedrys Maieri* [sic] Koidzumi in Tokyo Bot. Mag. XXX. 197 (1916).

CHINA: Yunnan.

Lithocarpus Merrittii, comb. nov. — *Quercus merrittii* Merrill in Philip. Jour. Sci. III. Bot. 325 (1908). — *Synaedrys Merrittii* Koidzumi in Tokyo Bot. Mag. XXX. 192 (1916).

PHILIPPINE ISLANDS.

Lithocarpus mindanaensis, comb. nov. — *Quercus philippinensis* Merrill

in Philip. For. Bur. Bull. i. 16 (1903), non A. De Candolle. — *Quercus celebica* Seemen in Perkins, Fragm. Philip. Fl. 41 (1904), non Miquel. — *Quercus acuminatissima* Merrill in Philip. Jour. Sci. iii. Bot. 326 (1908), non A. De Candolle. — *Quercus mindanaensis* Elmer in Leaf. Philip. Bot. iii. 942 (1910). — *Synaedrys acuminatissima* Koidzumi in Tokyo Bot. Mag. xxx. 190 (1916).

PHILIPPINE ISLANDS: Mindanao.

Lithocarpus monticola, comb. nov. — *Quercus monticola* King in Ann. Bot. Gard. Calcutta, ii. 44, t. 37 (1889). — *Synaedrys monticola* Koidzumi in Tokyo Bot. Mag. xxx. 197 (1916).

SUMATRA, BORNEO.

Lithocarpus omalokos, comb. nov. — *Quercus omalokos* Korthals in Verh. Nat. Geschied. Bot. 214 (1850). — *Cyclobalanus omalokos* Oersted in Naturh. For. Vidensk. Meddel. xviii. 80, t. 1-2, figs. 15-16 (1866). — *Quercus omalokos* Hooker f., Fl. Brit. Ind. v. 614 (1888). — King in Ann. Bot. Gard. Calcutta, ii. 70, t. 63B (1889). — *Pasania omalokos* Schottky in Bot. Jahrb. xlvii. 676 (1912). — *Synaedrys omalokos* Koidzumi in Tokyo Bot. Mag. xxx. 192 (1916).

SUMATRA.

Lithocarpus ovalis, comb. nov. — *Quercus glabra* Blanco, Fl. Filip. 727 (1837), non Thunberg. — *Quercus ovalis* Blanco, Fl. Filip. ed. 2, 502 (1845). — Merrill in Philip. Jour. Sci. iii. Bot. 325 (1908). — *Quercus Blancoi*, A. De Candolle, Prodr. xvi. pt. ii. (1864). — Vidal, Sin. Pl. Leñ. Filip. Atl. xli. t. 92, fig. c (1883). — *Cyclobalanus ovalis* Oersted in Naturh. For. Vidensk. Meddel. xviii. 81 (1866). — *Quercus induta* Fernandez-Villar, Nov. App. Fl. Filip. 207 (1883), non Blume. — *Quercus Teysmannii* Fernandez-Villar, l. c. (1883), non Blume. — *Synaedrys ovalis* Koidzumi in Tokyo Bot. Mag. xxx. 192 (1916).

PHILIPPINE ISLANDS.

Lithocarpus pachyphylla, comb. nov. — *Quercus pachyphylla* Kurz in Jour. As. Soc. Beng. xlv. pt. ii. 197, t. 14, figs. 1-4 (1875). — King in Ann. Bot. Gard. Calcutta, ii. 44, t. 38 (1889). — *Quercus Andersoni* King mser. apud C. B. Clarke in Jour. Linn. Soc. xv. 125 (1877), nomen. — *Pasania pachyphylla* Schottky in Bot. Jahrb. xlvii. 671 (1912). — *Synaedrys pachyphylla* Koidzumi in Tokyo Bot. Mag. xxx. 197 (1916).

INDIA: Sikkim.

Lithocarpus pallida, comb. nov. — *Quercus pallida* Blume, Bijdr. 524 (1825); Fl. Jav. Cupulif. 12, t. 4, 5 (1828-50). — King in Ann. Bot. Gard. Calcutta, ii. 57, t. 53A (1889). — *Quercus pseudo-molucca* var. *rostrata* Blume, Mus. Bot. Lugd.-Bat. i. 295 (1850). — *Quercus pseudo-molucca* var. *pallida* Miquel in Ann. Mus. Bot. Lugd.-Bat. i. 108 (1864-65). — *Synaedrys pallida* Koidzumi in Tokyo Bot. Mag. xxx. 1917 (1916).

JAVA, SUMATRA.

Lithocarpus philippinensis, comb. nov. — *Quercus philippinensis* A. De Candolle, Prodr. xvi. pt. ii. 97 (1864). — Merrill in Philip. Jour. Sci. iii. Bot. 328 (1908). — *Cyclobalanus philippinensis* Oersted in Naturh. For.

Vidensk. Meddel. XVIII. 80 (1866). — *Synaedrys philippinensis* Koidzumi in Tokyo Bot. Mag. xxx. 192 (1916).

PHILIPPINE ISLANDS: Luzon.

Lithocarpus platycarpa, comb. nov. — *Quercus platycarpa* Blume, Fl. Jav. Cupulif. 27, t. 15 (1828–51). — King in Ann. Bot. Gard. Calcutta, II. 70, t. 65 (1889). — *Cyclobalanus platycarpa* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 80 (1866). — *Synaedrys platycarpa* Koidzumi in Tokyo Bot. Mag. xxx. 192 (1916).

JAVA.

Lithocarpus polystachya, comb. nov. — *Quercus polystachya* Wallich, Cat. 2789 (1829), nomen. — A. De Candolle, Prodr. XVI. pt. II. 107 (1864) — King in Ann. Bot. Gard. Calcutta, II. 50, t. 44 (1889). — *Quercus bancana* Kurz, For. Fl. Burma, II. 485 (1877), non Scheffer. — *Pasania polystachya* Schottky in Bot. Jahrb. XLVII. 667, 668 (1912). — *Synaedrys polystachya* Koidzumi in Tokyo Bot. Mag. xxx. 197 (1916).

INDIA: Burma, Shan Hills. CHINA: Yunnan.

Lithocarpus pruinosa, comb. nov. — *Quercus pruinosa* Blume in Verh. Bat. Genoot. IX. 217 (1823); Fl. Jav. Cupulif. 9, t. 1 (1828–51). — King in Ann. Bot. Gard. Calcutta, II. 56, t. 53B (1889). — *Pasania pruinosa* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 83 (1866). — *Quercus pseudo-molucca* var. γ . *pruinosa* Wenzig in Jahrb. Bot. Gard. Berlin, IV. 227 (1886). — *Synaedrys pruinosa* Koidzumi in Tokyo Bot. Mag. xxx. 197 (1916).

JAVA.

Lithocarpus pseudo-molucca, comb. nov. — *Quercus pseudo-molucca* Blume in Verh. Bat. Genoot. IX. 214, t. 4 (1823); Fl. Jav. Cupulif. 14, t. 6 (1828–51). — King in Ann. Bot. Gard. Calcutta, II. 43, t. 36 (1889). — *Quercus angustata* Blume, l. c. 212 (1823); Fl. Jav. Cupulif. 15, t. 7 (1828–51). — *Quercus pseudo-molucca* var. γ . *angustata* Blume, Mus. Bot. Lugd.-Bat. I. 292 (1850). — *Quercus thelecarpa* Miquel in Pl. Junghuhn. I. 9 (1851–56). — *Pasania pseudomolucca* Oersted in Naturh. For. Vidensk. Meddel. XVII. 83 (1866). — *Synaedrys pseudomolucca* Koidzumi in Tokyo Bot. Mag. xxx. 197 (1916).

JAVA.

Lithocarpus pyriformis, comb. nov. — *Quercus pyriformis* Seemen in Bot. Jahrb. XXVII. beibl. LXIV. 17 (1900). — Koorders & Valeton, Bijdr. Booms. Java, x. 62 (1904). — *Synaedrys pyriformis* Koidzumi in Tokyo Bot. Mag. xxx. 198 (1916).

JAVA.

Lithocarpus rassa, comb. nov. — *Quercus rassa* Miquel, Fl. Ind. Bat. Suppl. 350 (1860). — King in Ann. Bot. Gard. Calcutta, II. 66, t. 60A (1889). — *Synaedrys rassa* Koidzumi in Tokyo Bot. Mag. xxx. 192 (1916).

MALESIA.

Lithocarpus Robinsonii, comb. nov. — *Quercus Robinsonii* Merrill in Philip. Jour. Sci. x. Bot. 297 (1915).

PHILIPPINE ISLANDS: Luzon.

Lithocarpus Skaniana, comb. nov. — *Quercus Skaniana* Dunn in Jour. Linn. Soc. xxxviii. 366 (1908). — *Pasania Skaniana* Schottky in Bot. Jahrb. xlvii. 675 (1912).

CHINA: Fokien.

Lithocarpus Soleriana, comb. nov. — *Quercus molucca* Blanco, Fl. Filip. 726 (1837), non Willdenow. — *Quercus concentrica* Blanco, Fl. Filip. ed. 2, 502 (1845), non Loureiro. — *Quercus costata* var. *convexa* Naves in Blanco, Fl. Filip. ed. 3, t. 441 (1883), non Blume. — *Quercus Reinwardtii* Fernandez-Villar, Nov. App. Fl. Filip. 207 (1883), non Korthals. — *Quercus Soleriana* Vidal, Rev. Pl. Vasc. Filip. 261 (1886). — *Quercus clementiana* Merrill in Philip. Jour. Sci. i. Suppl. 41 (1906), non King. — *Quercus Llanosii* Merrill in Philip. Jour. Sci. ii. 270 (1907), non A. De Candolle. — *Synaedrys Soleriana* Koidzumi in Tokyo Bot. Mag. xxx. 193 (1916).

PHILIPPINE ISLANDS.

Lithocarpus spicata (Smith) Rehder & Wilson var. **chittagonga**, comb. nov. — *Quercus spicata* var. *Chittagonga* King in Hooker f., Fl. Brit. Ind. v. 610 (1883; in Ann. Bot. Gard. Calcutta, ii. 49, t. 42, fig. 7 (1889)). — *Pasania spicata* var. *chittagonga* Schottky in Bot. Jahrb. xlvii. 665 (1912).

INDIA: Chittagong.

Lithocarpus spicata var. **gracilipes**, comb. nov. — *Quercus gracilipes* Miquel, Fl. Ind. Bat. Suppl. 347 (1860). — *Quercus spicata* d. *gracilipes* Miquel in Ann. Mus. Lugd.-Bat. i. 106 (1864-65). — King in Ann. Bot. Gard. Calcutta, ii. 48, t. 42, fig. 4 (1889). — *Pasania spicata* var. *gracilipes* Schottky in Bot. Jahrb. xlvii. 664 (1912).

INDIA: Kashia, Burma. MALESIA.

Lithocarpus submonticola, comb. nov. — *Quercus submonticola* Elmer in Leaf. Philip. Bot. iii. 943 (1910).

PHILIPPINE ISLANDS: Mindanao.

Lithocarpus sundaica, comb. nov. — *Quercus sundaica* Blume in Verh. Bat. Genoot. ix. 216 (1823); Fl. Jav. Cupulif. 11, t. 2, 3 (1828-51). — King in Ann. Bot. Gard. Calcutta, ii. 51, t. 47, 48 (1889). — *Quercus muricata* Roxburgh, Fl. Ind., ed. 2, iii. 635 (1832). — *Quercus mappacea* Korthals in Verh. Nat. Geschied. Bot. 202 (1839-42). — *Quercus Korthalsii* var. *mappacea* Blume, Mus. Bot. Lugd.-Bat. i. 293 (1850). — *Quercus Korthalsii* var. *kajan* Blume, l. c. (1850). — *Quercus Kajan* Miquel msc. apud Zollinger, Syst. Verz. 87 (1854). — *Pasania sundaica* Oersted in Naturh. For. Vidensk. Meddel. xviii. 83 (1866). — *Quercus pseudo-molucca* var. δ . *Korthalsii* Wenzig in Jahrb. Bot. Gart. Berlin, iv. 227 (1886), pro parte. — *Quercus pseudo-molucca* var. ϵ . *sundaica* Wenzig, l. c. (1886). — *Synaedrys sundaica* Koidzumi in Tokyo Bot. Mag. xxx. 198 (1916).

MALESIA.

Lithocarpus Teysmannii, comb. nov. — *Quercus annulata* Korthals in Verh. Nat. Geschied. Bot. 213, t. 46, figs. 21, 22 (1842), non Smith. — *Quercus Tysmannii* [sic] Blume, Mus. Bot. Lugd.-Bat. i. 300 (1850). — *Quercus Teysmannii* Miquel, Fl. Ind. Bat. i. 850 (1855). — Oudemans in Verh. Akad. Wet. Amsterd. xi. No. 3, 14, t. 8 (Annot. Cupul. Jav.) (1865). —

King in Ann. Bot. Gard. Calcutta, II. 71, t. 66 (1889). — *Quercus Korthalsii* Endlicher, Gen. Suppl. IV. pt. II. 28 (1847), non Blume. — *Quercus laurifolia* Miquel, Pl. Junghuhn. I. 11 (1850), non Michaux. — *Quercus hypoleuca* Miquel, Fl. Ind. Bat. I. 869 (1855). — *Quercus pseudo-annulata* Blume, Mus. Bot. Lugd.-Bat. I. 299 (1855). — *Cyclobalanus Tysmannii* Oersted in Naturh. For. Vidensk. Meddel. XVIII. 80 (1866). — *Pasania Tysmannii* Prantl in Engler & Prantl, Nat. Pflanzenfam. III. 1, 55 (188). — *Synaedrys Teysmani* Koidzumi in Tokyo Bot. Mag. XXX. 193 (1916).

JAVA.

Lithocarpus Thomsonii, comb. nov. — *Quercus Thomsoni* Miquel in Ann. Mus. Bot. Lugd.-Bat. I. 109 (1864-65), nomen. — Hooker f., Fl. Brit. Ind. V. 615 (1888). — King in Ann. Bot. Gard. Calcutta, II. 73, t. 69A (1889). — *Quercus turbinata* Roxburgh, Fl. Ind. ed. 2, III. 636 (1832), non Blume. — *Quercus leucocarpa* Hooker f. & Thomson msc. apud Wenzig in Bot. Jahrb. Bot. Gard. Berlin, IV. 225 (1886). — *Synaedrys Thomsonii* Koidzumi in Tokyo Bot. Mag. XXX. 193 (1916).

INDIA: Kasha, Burma.

Lithocarpus truncata, comb. nov. — *Quercus truncata* King in Ann. Bot. Gard. Calcutta, II. 84, t. 80 (1889). — *Pasania truncata* Schottky in Bot. Jahrb. XLVII. 663 (1912). — *Synaedrys truncata* Koidzumi in Tokyo Bot. Mag. XXX. 190 (1916).

INDIA: Assam.

Lithocarpus uvariifolia, comb. nov. — *Quercus uvariifolia* Hance in Jour. Bot. XXII. 227 (1884). — *Pasania uvariifolia* Hance in Jour. Bot. XXII. 227 (1884). — *Synaedrys uvariifolia* Koidzumi in Tokyo Bot. Mag. XXX. 198 (1916).

CHINA: Kiangsi, Kwantung.

Lithocarpus Wallichiana, comb. nov. — *Quercus Wallichiana* Lindley in Wallich, Cat. No. 2778 (1829). — Hance in Seemann Jour. Bot. VIII. 4 (1870). — King in Ann. Bot. Gard. Calcutta, II. 51, t. 46 (1889). — *Synaedrys Wallichiana* Koidzumi in Tokyo Bot. Mag. XXX. 193 (1916).

MALAY PENINSULA.

Lithocarpus Wenzelii, comb. nov. — *Quercus Wenzelii* Merrill in Philip. Jour. Sci. X. Bot. 267 (1915). — *Synaedrys Wenzelii* Koidzumi in Tokyo Bot. Mag. XXX. 193 (1916).

PHILIPPINE ISLANDS.

Lithocarpus Zschokkei, comb. nov. — *Quercus Zschokkei* Elmer in Leaflet. Philip. Bot. III. 944 (1910).

PHILIPPINE ISLANDS: Mindanao.

Quercus L.

Quercus Ilex L. var. *rotundifolia*, comb. nov. — *Quercus-Ilex Ilex* var. 4 *rotundifolia* Weston, Univ. Bot. I. 234 (1770). — *Quercus rotundifolia* Lamarck, Encycl. Méth. I. 723 (1785). — *Quercus Ballota* Desfontaines in Mém. Acad. Sci. Paris, 1790, 394, t. 6; Fl. Atlant. II. 350 (1800). — *Quercus Ilex* β . *Ballota* A. De Candolle, Prodr. XVI. pt. II. 39 (1864). — *Quercus Ilex* β . *Ballota* B. *rotundifolia* Coutinho in Bol. Soc. Broter. VI. 95 (1888).

There seems little reason to doubt that Weston's variety is the same as *Q. rotundifolia* Lam. and *Q. Ilex* β . *Ballota* A. DC., though the description is very short, but the only form with which it could have been confused is *Q. Ilex* var. *gramuntia* Loudon which is enumerated as a distinct variety by Weston.

Quercus lanuginosa Thuill. var. *Tenorei*, comb. nov. — *Quercus Dalechampii* Tenore, Ind. Sem. Hort. Neap. 1830, 15; Not. Syll. 469 (1831). — Ascherson & Graebner, Syn. Mitteleur. Fl. iv. 478 (1911). — *Q. pinnatifida* K. Koch in Linnaea, xxii. 326 (1849). — *Q. vulcanica* Boissier apud Kotschy, Chênes Eur. Or. t. 18 (1864). — *Q. Robur* II. *sessiliflora* B. *Tenorei* A. De Candolle, Prodr. xvi. pt. II. 7 (1864). — *Q. sessiliflora* γ . *pinnatifida* Boissier, Fl. Or. iv. 1164 (1879). — *Q. sessiliflora* var. *australis* Kotschy apud Wenzig in Jahrb. Bot. Gart. Berlin, iv. 190 (1886). — *Q. Tergestina* Wenzig, l. c. 191 (1886). — *Q. pubescens* f. *australis* Beck & Szyzylowicz in Rozpr. Wyzdz. Mat.-Przyrod. Akad. Krakow. xix. 59 (Pl. Cernag. Alban.) (1888). — *Q. croatica* β . *Tenorei* Pospichal, Fl. Oester, Kuestenl. I. 320 (1897). — *Q. lanuginosa* ζ *pinnatifida* Halacsy, Consp. Fl. Graec. III. 128 (1904), non C. Schneider. — *Q. sessilis* β . *decipiens* f. *australis* Beck, Fl. Bosn. II. 124 (1909). — *Q. Tenorei* Borzi in Boll. Ort. Bot. Palermo, x. 56, t. 4 (1910).

This variety differs from typical *Q. lanuginosa* chiefly in its deeply sinuately lobed leaves with about 5 narrow acute lobes on each side and can hardly be considered specifically distinct from the polymorphous *Q. lanuginosa*.

As the name for the species I have taken up *Q. lanuginosa* Thuillier (1799, not Lamarck 1778 which is a synonym of *Q. Cerris* L.) in preference of *Q. pubescens* Willdenow of 1796, since Willdenow states definitely under *Q. pubescens* in Species plantarum (iv. 450. 1805) that the species described under the same name in 1796 (Berlin. Baumz. 279) is not the same plant as the one described in his Species plantarum, but a variety of *Q. alba* L. which he now calls *Q. alba* γ . *pubescens*. Without this note one may easily be led to identify the *Q. pubescens* of 1796, the habitat of which is given as southern France, with *Q. lanuginosa* of Thuillier, except that Willdenow describes the leaves as attenuate at the base and on the shoots sometimes to 8 inches long, a size never attained by the leaves of *Q. lanuginosa*. It is, however, not quite clear what his *Q. alba* γ . *pubescens* really is, possibly a form of *Q. bicolor*.

× *Quercus hispanica* Lamarck, Encycl. Méth. I. 712 (1783), excl. var. γ . — (*Q. Cerris* × *Suber*). — *Q. pseudosuber* Santi, Viaggio Mont'Am. I. 156, t. 3 (1795). — Kotschy, Chênes Eur. Or. t. 35 (1864). — Ascherson & Graebner, Syn. Mitteleur. Fl. iv. 463 (1911). — *Q. Fontanesii* Gussone Ind. Sem. Hort. Boccadifalco, 10 (1826). — *Q. Ilex* var. *suberosa* Visiani, Fl. Dalmat. I. 208 (1842). — *Q. pseudosuber* 2. *Fontanesii* Loudon, Encycl. Trees, 885, fig. 1624 (1842). — *Q. Cerris* ϵ . *subperennis* A. De Candolle, Prodr. xvi. pt. II. 42 (1864).

Lamarck based his *Q. hispanica* on three different trees of unknown origin cultivated in the park of Trianon near Paris. The first two forms called α . Chêne de Gibraltar and β . Chêne à feuilles d'Aegylops are apparently identical with the Fulham and Lucombe Oaks of English gardens which originated about 1765 and are undoubtedly hybrids between *Q. Cerris* L. and *Q. Suber* L. The third form called γ . turnère is *Q. Turneri* Willd. probably a hybrid between *Q. Ilex* and *Q. robur*. The *Q. pseudosuber* of Santi of which I have seen numerous specimens from different localities I am unable to distinguish from the cultivated forms of the hybrid between *Q. Cerris* and *Q. suber*. It seems to occur in southern Europe only in scattered individuals in regions where *Q. Cerris* is native and where *Q. suber* is found either wild or cultivated; e.g. near Pola, Istria, where *Q. pseudosuber* has been observed, old trees of *Q. suber* exist, as stated by Hempel & Wilhelm (Bäume & Sträuch. II. 82). Even if *Q. pseudosuber* should be found in localities where at present no cultivated trees of *Q. suber* exist, this would be no proof against its hybrid origin, as trees of *Q. suber* may have existed and succumbed to a severe winter, while the hybrid which is more resistant has survived.

Several distinct forms of this hybrid occur in cultivation of which the following are the most distinct and best known. To avoid confusion I have preserved for the typical form its oldest varietal name.

× *Q. hispanica* var. *dentata*, comb. nov. — *Q. hispanica* α . "Chêne de Gibraltar" Lamarck, Encycl. Méth. I. 712 (1783). — *Q. Cerris* var. *dentata* Watson, Dendr. Brit. II. t. 93 (1825). — *Q. Cerris* 8. *fulhamensis* Loudon, Arb. Brit. III. 1850, fig. 1710 (1838). — *Q. pseudosuber* ϵ . *gibraltarica* A. De Candolle, Prodr. XVI. pt. II. 44 (1864). — *Q. Cerris* ϵ . *subperennis* α . *Fulhamensis* Dippel, Handb. Laubh. II. 96 (1892). — *Q. fulhamensis* Zabel in Beissner, Schelle & Zabel, Handb. 70 (1903). — *Q. Lucombeana* var. α . *fulhamensis* Henry in Elwes & Henry, Trees Gt. Brit. v. 1261, t. 335, fig. 21 (1910).

This form is chiefly characterized by its pyramidal habit with moderately corky branches, by its generally elliptic-ovate leaves with 5-8 teeth, and by the hemispheric cup with the scales usually all reflexed. It is the typical form and is not identical with *Q. Cerris Lucombeana dentata* Loud. (*Q. Lucombeana* var. *dentata* Henry).

× *Q. hispanica* var. *latifolia*, comb. nov. — *Q. Lucombeana* var. *fulhamensis latifolia* Henry in Elwes & Henry, Trees Gt. Brit. v. 1262 (1910). — *Q. fulhamensis latifolia* Hort. ex Henry, l. c., pro synon.

This form differs from the preceding chiefly in its broader, less strongly dentate leaves.

× *Q. hispanica* var. *Lucombeana*, comb. nov. — *Q. hispanica* β . "Chêne à feuilles d'Aegylops" Lamarck, Encycl. Méth. I. 723 (1783). — *Q. aegylopiifolia* Persoon, Syn. II. 570 (1807). — *Q. Lucombeana* Sweet, Hort. Brit. 370 (1827). — Henry in Elwes & Henry, Trees Gt. Brit. v. 1259, t. 335, fig. 23 (1910). — *Q. Cerris* var. *Lucombeana* Loudon, Arb. Brit. III. 1851, figs. 1711-14 (1838). — *Q. exoniensis* Loddiges ex Loudon, l. c., pro synon. —

Q. pseudosuber δ . *aegylopiifolia* A. De Candolle, Prodr. xvi. pt. II. 44 (1864). — *Q. Cerris* e. *subperennis* β . *Lucombeana* Dippel, Handb. Laubh. II. 97 (1892). — *Q. fulhamensis* *Lucombeana* Zabel in Beissner, Schelle & Zabel, Handb. 71 (1903).

This variety forms a round-headed tree with the bark not corky; the leaves are narrower and longer than in the typical form and have about 7 pairs of triangular large teeth; the subulate scales of the turbinate cup are partly reflexed and partly erect.

× *Q. hispanica* var. *crispa*, comb. nov. — *Q. Cerris* 10. *Lucombeana crispa* Loudon, Arb. Brit. III. 1856 figs. 1715, 1717c, 1718 (1838). — *Q. Lucombeana* var. *crispa* Henry in Elwes & Henry, Trees Gt. Brit. v. 1261 (1910).

This differs from the preceding variety chiefly in the very corky bark and in the smaller leaves with wrinkled margin.

× *Q. hispanica* var. *heterophylla*, comb. nov. — *Q. Cerris* 14. *heterophylla* Loudon, Arb. Brit. III. 1857, fig. 1719 (1838). — *Q. Lucombeana* var. *heterophylla* Henry in Elwes & Henry, Trees Gt. Brit. v., 1261 (1838).

Leaves oblong, irregularly and deeply lobed, in the middle often with a deep wide sinus on each side leaving only a narrow margin at the midrib.

× *Q. hispanica* var. *diversifolia*, comb. nov. — *Q. Ilex* var. *diversifolia* Hort. apud Nicholson, Hand-list Arb. Kew, II. 189 (1896). — *Q. Lucombeana* var. *diversifolia* Henry in Elwes & Henry, Trees Gt. Brit. v. 1262, t. 339, fig. 71 (1910).

The leaves are somewhat similar to those of the preceding form, but are smaller; the cup of the fruit is hemispheric with shorter partly appressed scales; the branches ascending, the bark corky.

Quercus sessiliflora Salisb. f. *insecata*, nom. nov. — *Q. sessiliflora* γ . *laciniata* Koehne, Dendr. 130 (1893), not Duchartre. — Spaeth in Mitt. Deutsch. Dendr. Ges. XXII. 138, figs. 18–20 (1913).

This is a peculiar form with deeply incisely lobed leaves, the narrow lobes pointing forward. It had to receive a new name on account of the older homonym *Q. sessiliflora laciniata* DC. apud Duchartre in Jacques & Hérincq, Man. Pl. IV. 254 (1857) which is probably the same as *Q. robur* β . *laciniata* Lamarck, Encycl. Méth. I. 717 (1785) and represents a form with deeply lobed leaves, but otherwise similar to those of the type.

Quercus robur f. *holophylla*, nom. nov. — *Q. sessiliflora longifolia* Jurrisen & Zoon, Prijs-Cour. 49 [190.?], nomen. — *Q. pedunculata* var. *longifolia* Bean, Trees & Shrubs, II. 321 (1914), not Kirchner.

This very distinct and peculiar form differs from the type in its elliptic to oblong entire leaves obtuse at apex and auricled at base; the fruits are borne on a very long and slender stalk. Nothing is known to me of its origin; it was received at the Arnold Arboretum in 1903 from the nursery of Jac. Jurrisen & Zoon of Naarden, Holland. The form had to receive a new name on account of the older *Q. pedunculata* 22. *cucullata longifolia* Kirchner in Petzold & Kirchner, Arb. Musc. 622 (1864) (*Q. robur* var. *cucullata longifolia* Hartweg & Rümpler, Bäum. Sträuch. 440 1875).

Quercus aliena Bl. var. *pubipes*, var. nov.

A typo praecipue differt foliis minoribus latioribus subtus pilis fasciculaist suberectis ad costam nervosque densius in facie sparsius obsitae, petiolis pubescentibus circiter 1 cm. longis, ramulis novellis parce strigoso-pilosis. — Folia obovata, 7–10 cm. longa et 4–8 cm. lata, obtuse dentata dentibus utrinque 8–10, supra opace cyaneo-viridia, fere glabra, subtus cinereo-viridia, molliter pubescentia.

CHINA. Chikung-shan, border of Honan and Hupeh, alt. 1500–2500 feet, low shrub, 3–4 feet, June 13, 1917, *L. H. Bailey*.

Though the specimen before me is sterile I have little doubt that it belongs to *Q. aliena* Blume from the typical form of which it differs, however, markedly in the sparingly pilose branchlets, in the pubescent petioles and in the grayish and soft pubescence of the under side of its leaves, particularly dense on the midrib and on the nerves which are quite glabrous in the typical form, while the surface is covered by a whitish dense tomentum. On account of the broadly obovate grayish pubescent leaves this variety has the appearance of a small-leaved form of *Q. dentata* Thunberg, but that species is easily distinguished by the tomentose branchlets and by the nearly sessile more coarsely toothed and usually very large leaves.

In the same locality Dr. Bailey collected a specimen of *Q. aliena* which has the under side of the leaves nearly glabrous or only sparingly pubescent and which I refer to *Q. aliena* var. *pellucida* Blume. To the same variety apparently belong specimens collected by Dr. Bailey near Kioshan in the province of Honan of which one is remarkable for its slender petioles 2–3 cm. long and for the auricled base of the leaves which are 9–15 cm. long.

Quercus dentata Thunberg.

Though Thunberg's description of *Q. dentata* can hardly be applied to any other species than the one generally known under that name, a glance at his figure in his *Icones Plant. Jap.* v. t. [6] creates a suspicion that Thunberg's species may possibly not be our *Q. dentata*. The branch represented in that plate looks much more like *Q. aliena* var. *acuteserrata* Maximowicz than our *Q. dentata*. Upon my request Professor O. Juel has kindly sent an excellent photograph of Thunberg's type consisting of a flowering branch with half-grown leaves and tells me that this specimen is the only one labeled *Q. dentata* in Thunberg's own handwriting. The photograph shows that the specimen represents without the slightest doubt our *Q. dentata*, but as the leaves are only half-grown, they have not yet reached their full width and their uncompletely developed lobes look more like acutish teeth. In comparing the photograph with the plate one readily sees that the drawing has been based on this specimen, but the artist apparently took many liberties particularly in representing the leaves as distinctly petioled and the lobes of the leaves as more acute and more regular than they really are, and in selecting as the type for the leaves the narrowest of the half-grown leaves, neglecting entirely the more developed broader leaves on the specimen.

ULMACEAE

Ulmus glabra f. *cornuta*, comb. nov. — *U. campestris cornuta* David in Rev. Hort. ser. 2, iv. 102 (1845-46). — *U. triserrata* Hort. apud Kirchner in Petzold & Kirchner, Arb. Musc. 567 (1864). — *U. intermedia* Hort. ex Kirchner, l. c., as synonym. — *U. scabra* e. *U. tricuspis* K. Koch, Dendr. II. pt. 1. 415 (1872). — *U. tridens* Hort. ex Koch, l. c., as synonym. — *U. montana* var. *triserrata* Lavallée, Arb. Segrez. 237 (1877). — *U. montana* var. *tridens* Lange, Haandb. Dansk. Fl. 267 (1887). — *U. scabra* f. *tricuspis* Dippel, Handb. II. 29 (1892). — *U. montana* f. *lobata* Waisbecker in Oestr. Bot. Zeitschr. XLIX. 67 (1899). — *U. montana* ? *tricuspis* Schelle in Beissner, Schelle & Zabel, Handb. 86 (1903). — *U. scabra* f. *heterophylla* Schneider, Handb. Laubh. I. 218 (1904), pro parte. — *U. montana* a. *corylifolia* Zapałowicz, Consp. Fl. Galic. II. 98 (1908). — *U. glabra* f. *tricuspis* Rehder in Mitt. Deutsch. Dendr. Ges. XXIV. (1915) 216 (1916).

This form has large leaves which are partly, at least at the ends of the more vigorous branches, 3- or sometimes 5-lobed at the broad apex. It has usually been confused with *U. laciniata* Mayr (*U. major* var. *heterophylla* Maxim. & Rupr.), a species of Eastern Asia, chiefly distinguished by its light colored branchlets and by the leaves which are nearly all 3-lobed at the apex, such leaves not being confined to the end of the more vigorous branches, as in this form of *U. glabra*.

Ulmus laciniata Mayr var. *nikkoensis*, var. nov.

A typo praecipue recedit foliis minoribus latioribus subtus sparse pubescentibus junioribus plus minusve purpurascentibus. — Folia late obovata apice plerumque triloba, 6-11 cm. longa, subtus scabrida pilis brevibus satis sparsis in costa et nervis venulisque, ceterum glabra; ramuli annotini fusco-cinerei.

JAPAN. Hondo; Nikko region, Lake Chuzenji, alt. 1600 m., plants collected by J. G. Jack, October, 1905, and growing now in the Arnold Arboretum.

This variety differs chiefly in its smaller, usually broadly obovate leaves rather sparingly short-pubescent on the nerves and veinlets beneath and scabrid to the touch, while in the typical form the under side of the leaves is covered by a grayish rather dense and soft pubescence and the leaves are oftener oblong-obovate and usually more than 10 cm., often to 15 cm. long. According to our growing plants the variety forms a smaller tree of slenderer habit particularly striking in spring on account of the purplish color of the unfolding leaves which is retained a long time and changed in summer to dark green, while the leaves of the typical form are light green when unfolding.

I have seen no herbarium material of *U. laciniata* from Hondo, but according to Japanese botanists it occurs in central Japan. The specimens from Hokkaido I have seen belong to the typical form and agree with specimens from Manchuria.

Ulmus procera Salisbury, Prodr. Stirp. Allerton, 391 (1796). — *Ulmus campestris* Linnaeus, Spec. I. 225 (1753), pro parte.; Fl. Angl. 11 (1754). — Miller, Dict. ed. VIII. No. 1 (1768).¹ — Weston, Univ. Bot. I. 314 (1770). — Henry in Elwes & Henry, Trees Gt. Brit. VII. 1903, t. 412, fig. 14 & t. 396 (1913). — Moss in Gard. Chron. ser. 3, LI 199 (1912); Cambridge Brit. F. II. 94, t. 102 (1914). — *U. campestris* a. *vulgaris* Solander apud Aiton, Hort. Kew. I. 319 (1789). — Planchon in Ann. Sci. Nat. sér. 3, x. 273 (1848); in De Candolle, Prodr. XVII. 156 (1873). — *U. suberosa* Smith, Engl. Bot. XXXI. t. 2161 (1810), non Ehrhart, nec Moench. — *U. atinia* Walker, Essays Nat. Hist. 70 (1812). — *U. surculosa* var. *latifolia* Stokes, Mat. Med. II. 37 (1812). — *U. vulgaris* Dumortier, Fl. Belg. 25 (1827). — *U. suberosa* var. *vulgaris* Hooker & Arnott, Brit. Fl. 376 (1850), ex parte. — *U. germanica* Hartig, Forstl. Kulturpfl. 460 (1851). — *U. campestris* var. *major* Trautvetter in Bull. Acad. Sci. St. Petersb. xv. 351 (1857), pro parte, non Walpers. — *U. campestris* a. *vulgatissima* Miller apud Boulger in Gard. Chron. n. ser. XII. 298 (1897). — *U. glabra* b. *pilifera* Borbas, Bekesvarmeg. Fl. 55 (1881). — *U. pilifera* Borbas, Közl. Bekesvarmeg. Fl. in Vandorg. Munkal. XXV. (486) (1881), ex Ascherson & Graebner. — *U. asperrima* Nagi, Varad. Termesz. 124 (1890). — *U. campestris* β. *germanica* f. *pubescens* Pospichal, Fl. Oester. Kuestenl. I. 347 (1897). — *U. glabra* Mill. b. *pubescens* Schneider, Ill. Handb. I. 220 (1904). — *U. surculosa* Ley in Jour. Bot. XLVIII. (1910). — *U. campestris* a. *latifolia* l. *pubescens* Ascherson & Graebner, Syn. Mitteleur. Fl. IV. 557 (1911).²

The correct name for this species which had been confused by many authors with *U. foliacea* Gilib. (*U. glabra* Mill., non Huds., *U. nitens* Moench) has been a matter of much dispute. There can be no doubt that like the other European species it formed a part of Linnaeus' *U. campestris*, but to consider it the type of that species is certainly not correct. If we try to ascertain the type of *U. campestris* L., we should turn for a clue first to the citations of Linnaeus in his own publications. The first citation in the Species plantarum is Hort. Cliffort. 83; where we find under *Ulmus fructu membranaceo* three varieties "α, β, γ" enumerated; the first which must be considered the type of this aggregate is "α. *Ulmus folio latissimo scabro* Tournefort" which is *U. glabra* Hudson; also the following citation Fl. Suec. 219 must refer to *U. glabra* Huds., as this is the only or at least the most widely distributed species in Sweden; this is confirmed by the figure in Svensk Botanik by Palmstuch & Venus (1802) where the species figured as *U. campestris* on plate 13 represents *U. glabra*

¹ Henry refers *Ulmus campestris* Miller to *U. montana* With. (= *U. glabra* Hudson), but Miller describes that species under the name *U. scabris* to which he ascribes leaves six inches long, while of his *U. campestris* he says that the leaves are about 3 inches long and come out late, which is true of *U. procera* as compared with *U. glabra* Hudson. Furthermore it is most likely that Miller's *U. campestris* is the same species as the *U. campestris* of his contemporaries Weston and Solander; this is also the opinion of Moss.

² Ascherson & Graebner cite as a synonym *Ulmus campestris* var. *pubescens* Planchon in De Candolle, Prodr. XVII. 156, but no such combination can be found there; the word *pubescens* is the beginning of the description; they also cite Ann. Sci. Nat. 3, sér. "III" [IX] where no reference at all to a pubescent form occurs.

Huds., and also by the material in our herbarium. The third citation Mat. Med. 105 refers without doubt to the same species, as he gives *Europae nostrae pagi* as the habitat. A further proof that Linnaeus had *H. glabra* Huds. in mind, is the fact that he places the genus in Pentandria, the native *U. glabra* being probably the only species of which he had examined the flowers; if he had examined *U. procera*, he ought to have placed the genus in Tetrandria. Finally may be added that the specimen of *U. campestris* in Linnaeus' herbarium represents *U. glabra* Huds., though this is no conclusive evidence, as the specimen in this case is not the type of his species. All this shows, that if we restrict *U. campestris* L. to one of the species now recognized, it must be considered the oldest name for *U. glabra* Hudson, but it is probably better to take advantage of art. 51. 4 of the International Code and let the name lapse, as it would make the nomenclature of *Ulmus* still more confused than it is already. The reason advanced by Moss and by Henry for restricting the name *U. campestris* to *U. procera* is the fact that Linnaeus in his *Flora Anglica* (p. 11), published one year after the *Species plantarum*, cites under *U. campestris* a reference to Ray's *Synopsis* 468-1; this reads in Ray's work "1. *Ulmus vulgatissima folio lato scabro*" which is *U. procera*. Whatever the reason may have been to omit *Ulmus* 2-4 of Ray's *Synopsis*, it was certainly not the intention of Linnaeus to change his conception of *U. campestris*, for in the second edition of his *Species plantarum* he did not make the slightest change in the wording of the diagnosis or of the citations. The type of a species, moreover, cannot be changed by any subsequent publication, and moreover the *Flora anglica* is a simple compilation containing only the bare names followed by a reference to Ray's *Synopsis*, and is without the slightest taxonomic importance. If we follow Henry *Ulmus sativa* Mill. would be the next oldest name, but this view is not shared by Moss who takes up *U. sativa* as the oldest name for the species called by Henry *U. minor* Mill., and I am more inclined to follow Moss. Miller's citation under *U. sativus* certainly favors the opinion of Moss. Miller in his description says little, but under his *U. campestris* states that "the branches do not grow as erect as those of the third sort" (= *U. sativus*), this might point to the Cornish Elm which is not mentioned otherwise by Miller, but according to Weston was in cultivation at that time. In any case the status of *U. sativus* Mill. is rather doubtful, while *Ulmus procera* of Salisbury is based exclusively on *U. campestris* a. *vulgaris* Solander which is the *Ulmus vulgatissima folio lato scabro* of Gerard and without doubt the species known at present as the English Elm.

Ulmus procera f. *argenteo-variegata*, comb. nov. — *U. campestris* 2. *argenteo-variegata* Weston, Bot. Univ. i. 314 (1770). — *U. campestris* var. *foliis variegatis* Loddiges apud Loudon, Arb. Brit. iii. 1376 (1838). — *U. campestris* a. *vulgatissima* 1. *variegata* (Loud.) Boulger in Gard. Chron. n. ser. xii. 298 (1879). — *U. campestris* var. *variegata* Dippel, Handb. Laubh. ii. 25 (1892).

Weston's *U. campestris argenteo-variegata* is certainly referable to this

species as he characterized his *U. campestris* as *U. vulgarissima foliis latis scabris*.

Ulmus procera f. *purpurea*, comb. nov. — *Ulmus campestris* var. *purpurea* H. Vilv. apud Wesmael in Bull. Fed. Soc. Hort. Belg. 1862, 390 (1863). — *U. campestris* 17. *purpurea* Kirchner in Petzold & Kirchner, Arb. Musc. 557 (1864). — *U. purpurea* Hort. ex Kirchner, l. c., as synonym.

Ulmus procera f. *purpurascens*, comb. nov. — *U. campestris myrtifolia purpurea* De Smet, Cat. No. 10, 59 (1877), not *U. campestris* var. *purpurea* Wesmael. — ? *U. campestris* var. *purpurascens* Lavallée, Arb. Segrez. 236 (1877), nomen. — *U. glabra* Mill. var. *pubescens* f. *purpurascens* Schneider, Ill. Handb. i. 220 (1904). — *U. campestris* a. *latifolia* l. *pubescens* c. *Berardii* lus. *purpurascens* Ascherson & Graebner, Syn. Mitteleur. Fl. iv. 558 (1911). — *U. campestris* var. *purpurascens* Henry in Elwes & Henry, Trees Gt. Brit. vii. 1905 (1913).

Ulmus procera, f. *Vanhouttei*, comb. nov. — *U. campestris* "Louis Van Houtte" Deegen in Ill. Monatsh. Gartenb. v. 103 (1886). — *U. montana lutescens Vanhouttei* Schelle in Beissner, Schelle & Zabel, Handb. 86 (1903). — *U. glabra* Mill. var. *pubescens* f. *van houttei* Schneider, Ill. Handb. i. 220 (1904). — *U. campestris* a. *latifolia* l. *pubescens* c. *Berardii* lus. *Van Houttei* Ascherson & Graebner, Syn. Mitteleur. Fl. iv. 558 (1911). — *U. campestris* var. *Vanhouttei* Henry in Elwes & Henry, Trees Gt. Brit. vii. 1905 (1912).

Ulmus procera var. *Berardii*, comb. nov. — *U. campestris* var. *Berardi* Simon-Louis, Cat. 1869, p. 96, fig. 7. — Carrière in Rev. Hort. 1873, 340. — *U. glabra* Mill. var. *pubescens* f. *berardii* Schneider, Ill. Handb. i. 220, figs. 136 1-m. (1904). — *U. campestris* a. *latifolia* l. *pubescens* c. *Berardi* Ascherson & Graebner, Syn. Mitteleur. Fl. iv. 558 (1911). — *U. nitens* var. *Berardi* Bean, Trees & Shrubs, ii. 618 (1914).

This variety approaches in its nearly glabrous leaves *U. foliacea* Gilib., but the petioles and the young branchlets are pubescent. Flowers and fruits are yet unknown.

Ulmus procera var. *viminalis*, comb. nov. — *U. campestris* var. *viminalis* Loudon, Arb. Brit. iii. 1376, vii. t. 185a (1838). — *U. viminalis* Loddiges ex Loudon, l. c., pro synonym. — K. Koch, Dendr. ii. pt. i. 418 (1872), pro forma *U. scabrae*. — *U. antarctica* Hort. apud Kirchner in Petzold & Kirchner, Arb. Musc. 551 (1864). — *U. gracilis* Hort. ex Kirchner, l. c., pro synonym. — *U. campestris* a. *vulgarissima* 3. *viminalis* Masters apud Boulger in Gard. Chron. n. ser. xii. 298 (1879). — *U. campestris* var. *gracilis* Hartwig & Rümpler, Bäum. Sträuch 580 (1879). — *U. scabra* var. *viminalis* Dippel, Handb. Laubh. ii. 30 (1892). — *U. scabra* f. *major viminalis* Voss, Vilmorin's Blumengaert. ed. 3, i. 906 (1895). — *U. montana* var. *viminalis* f. *gracilis* Baenitz, Herb. Dendr. (1901), in sched. — *U. montana viminalis* Schelle in Beissner, Schelle & Zabel, Handb. 85 (1903). — *U. montana viminalis gracilis* Schelle, l. c. (1903). — *U. glabra* Mill. var. *pendula* f. *viminalis* Schneider, Ill. Handb. i. 220, fig. 136 n (1904). — *U. glabra* var. *pendula* f. *antarctica* Schneider, l. c. fig. 136 o (1904). — *U. campestris* a.

glabra a. *vulgaris* lus. *viminalis* Ascherson & Graebner, Syn. Mitteleur. Fl. iv. 554 (1911). — *U. campestris* a. *glabra* a. *vulgaris* lus. *antarctica* Ascherson & Graebner, l. c. (1911). — *U. viminalis* Loddiges apud Bean, Trees & Shrubs, II. 621 (1914).

The form named *gracilis* (*antarctica*) has been distinguished from *viminalis* by the more deeply incised usually obovate leaves, but the two forms of leaves pass gradually into each other and may be found even on the same plant.

Ulmus procera var. *viminalis* f. *aurea*, comb. nov. — *U. campestris* var. *aurea* Morren in Belg. Hort. xvi. t. 356–57 (1866). — Lemaire in Ill. Hort. xiv. t. 513 (1867). — *U. Rosseelsi* K. Koch, Dendr. II. pt. I. 412 (1872), pro forma *U. scabrae*. — *U. campestris* var. *antarctica aurea* Nicholson, Hand-list Arb. Kew, II. 135 (1896). — *U. montana viminalis gracilis aurea* Schelle in Beissner, Schelle & Zabel, Handb. 86 (1903). — *U. campestris Rosscelsii* [sic] Schelle, l. c. 83 (1903). — *U. campestris* var. *viminalis aurea* Henry in Elwes & Henry, Trees Gt. Brit. VII. 1907 (1913). — *U. viminalis* var. *aurea* Bean, Trees & Shrubs, II. 621 (1914).

Ulmus procera var. *viminalis* f. *marginata*, comb. nov. — *U. campestris* 14. *viminalis marginata* Hort. apud Kirchner in Petzold & Kirchner, Arb. Musc. 556 (1864). — *U. campestris* var. *viminalis variegata* Nicholson, Hand-list Arb. Kew, II. 137 (1896). — *U. montana viminalis marginata* Schelle in Beissner, Schelle & Zabel, Handb. 85 (1903). — *U. viminalis* var. *variegata* Bean, Trees & Shrubs, II. 621 (1914).

Ulmus procera var. *australis*, comb. nov. — *U. campestris* var. *australis* Henry in Elwes & Henry, Trees Gt. Brit. 1904, t. 412, fig. 17 (1910).

Ulmus pumila L. var. *pilosa* Rehder, var. nov.

A typo recedit ramulis junioribus rubro-brunneis dense pilosis pilis patulis, tomento ad tertium annum persistente, foliis junioribus supra pilis accumbenti-setulosis scabra, subtus ad costam et nervos pilosis, petiolis brevibus pilosis. — Arbor 10-metralis: folia elliptico-ovata, acuminata, subsimpliciter serrata, 2–3.5 cm. longa; petioli 1–2 mm. longi, pilosuli: samara brevissime pedicellata, suborbicularia vel rotundato-ovalia, 12–14 mm. longa et 10–12 mm. lata, apice profunde emarginata, sinus lateribus valde curvatis et sese tegentibus.

CHINA. Yunnan: Pe-yen-tsin, May 7, 1916, *Siméon Ten* (No. 89, ramuli foliiferi, type); March 1, 1917, *Siméon Ten* (No. 307, ramuli fructiferi).

This variety agrees in size and shape of leaf and fruit exactly with typical *U. pumila*, but differs in the dense pilose pubescence and in the reddish brown color of the young branchlets and in the pubescence of the leaves and their short petioles. Typical *U. pumila* as a rule is quite glabrous and the only specimens with pubescent branchlets I have seen are F. N. Meyer's No. 928, a specimen collected by Purdom near Peking, and Wilson's No. 1565 from Kiangsi, but the pubescence of the first two of these specimens is minutely villous and not at all pilose, while Wilson's specimen has

the branchlets sparingly pilose; Meyer's specimen approaches our variety also in the red-brown color of the branchlets and in the very short petioles.

Ulmus pumila has not before been recorded from Yunnan, but I suspect that the Elm enumerated by Lévillé in his Cat. Pl. Yun-Nan, p. 276 (1917) as *U. parvifolia* Jacquin is this new variety.

***Zelkova serrata* Makino**

CHINA. Hunan: prope urbem Wukang, in silva frondosa elata umbrosa montis Yun-shan, alt. 1000 m., August 7, 1917, *H. v. Handel-Mazzetti*, No. 399 (Diar. No. 2204).

The material in the Arboretum herbarium from China proper, formerly referred to *Zelkova serrata* (*Z. acuminata* Planch.) has been found to belong to *Zelkova sinica* Schneider (in Sargent, Pl. Wilson. III. 286 [1916]). We therefore concluded that *Z. serrata* is restricted to Japan and Korea. The specimen cited above, however, which is undoubtedly true *Z. serrata*, as it agrees exactly with specimens from Japan proves that *Z. serrata* extends far into southern China; Wukang being situated in the southwestern part of Hunan not very far from the border of Kwangsi.

Zelkova sinica is apparently a species of more northern distribution, ranging from Shansi to Kansu and south to Hupeh and northern Chekiang. To which species Carles' specimen from Tahoe Lake in Chekiang cited by Hemsley belongs I am unable to say, as I have not seen it.

MORACEAE

***Morus mongolica* Schneid. var. *vestita* var. nov.**

A typo recedit foliis supra satis dense setuloso-pubescentibus, subtus dense molliter villosis; petiolis pedunculisque villosulis.

CHINA. Yunnan: Sou-pin-chao via Pe-yen-tsin ad Pien-kio, April 20, 1917, *Siméon Ten* (No. 321; arbor 5-10 m. altus, floribus albis, typus); "rochers des couteaux à Pan-pien-kai," alt. 2500 m. May, 1912, *E. E. Maire*.

These specimens agree in all characters exactly with typical *M. mongolica* except in the pubescence of the leaves and of the peduncles which are glabrous or nearly glabrous in the type.

BERBERIDACEAE

***Mahonia repens* f. *subcordata*, f. nov.**

A typo recedit foliolis 5-7, rarius 9, approximatis late ovatis basi subcordatis, dentibus paucis remotis fere ad mucronem reductis interdum fere integris.

Cultivated at Highland Park, Rochester, N.Y. (Type specimen coll. May 10-11, 1913, by *R. E. Horsey* & *J. Bishop*, preserved in the Arnold Arboretum Herb.)

This is a rather distinct looking form characterized by the 5-9-foliate leaves with broad and crowded leaflets partly overlapping at the subcordate base.

× *Mahonia Wagneri*, comb. nov. — (*M. Aquifolium* × *pinnata*. — *Maho-*

nia pinnata var. *Wagneri* Jouin in Mitt. Deutsch. Dend. Ges. XIX. 90, fig. 290 (1910). — Fedde, Rep. Spec. Nov. XIII. 364 (1914). — *Berberis pinnati* var. *Wagneri* Rehder in Mitt. Deutsch. Dendr. Ges. XXI. 184 (1912).

This hybrid resembles in its habit and in the axillary inflorescences *M. pinnata* Fedde, but the leaflets are thinner and slightly lustrous and the petioles are slenderer, often attaining 3 cm. in length, while on other parts of the same plant they may be scarcely 5 mm. long; the usually 9 or 11 leaflets are mostly ovate-lanceolate and sinuately dentate with 4 or 5 spiny teeth on each side. *Mahonia Wagneri* is about as hardy as *M. Aquifolium*, but grows much taller, reaching a height of 2.5 m. When and where it originated is not known; it has been in cultivation in the Nursery of Simon-Louis Frères at Plantières near Metz since 1863. In gardens it is sometimes found under the name of *M. fascicularis*.

CALYCANTHACEAE

Calycanthus fertilis var. *ferax*, comb. nov. — *C. ferax* Michaux, Fl. Bor.-Am. I. 305 (1803). — *C. laevigatus* Willdenow, Enum. Pl. Hort. Berol. 559 (1809). — *C. pennsylvanicus* Loddiges ex Loudon, Arb. Brit. II. 937 (1838), pro synonym. — *Butneria nana* Small, Fl. S. E. U. S. 528 (1903), pro parte. *Butneria fertilis* b. *ferax* Schneider, Ill. Handb. I. 344 (1905). — *Calycanthus fertilis* var. *laevigatus* Bean, Trees & Shrubs, I. 283 (1914).

This variety differs chiefly in the green under side of the leaves which is glaucous in typical *C. fertilis*. The closely related *C. fertilis* var. *nanus* Schelle (*C. nanus* Lois.) is likewise green on the under side of the leaves, but smaller in every part.

LAURACEAE

Umbellularia californica Nutt. f. *pendula*, nom. nov. — *U. californica* "pendulous form" Jepson, Silv. Cal. 243, t. 76 (1900).

Near Olema, Marin Co. and northward, according to Jepson.

A tree with wide-spreading branches forming a crown broader than high and with slender pendulous branchlets. A very ornamental form to be recommended for cultivation.

Litsea sericea Hooker f., Fl. Brit. Ind. v. 156 (1886). — Gamble in Sargent, Pl. Wilson. II. 75 (1914). — *Tetranthera sericea* Wallich, Cat. No. 2545 (1829), nomen. — Nees in Wallich, Pl. As. Rar. II. 67 (1831). — *Tetranthera sikkimensis* Meissner in De Candolle, Prodr. xv. pt. I. 181 (1864). — *Lindera umbellata* Hemsley in Jour. Linn. Soc. XXVI. 393 (1891), pro parte, non Thunberg. — Gamble in Sargent, Pl. Wilson. II. 81 (1914). — *Lindera membranacea* Hemsley, l. c. 389 (1891), pro parte, non Maximowicz. — Gamble, l. c. (1914).

The Chinese specimens referred to *Lindera umbellata* and *L. membranacea* by Hemsley and Gamble, as far as I have seen them, belong to *Litsea* except a specimen from Ningpo which may be true *Benzoin umbellatum*, and except Wilson's No. 1634 from Kiangsi and his No. 3675 from Szechuan

which may or may not belong to *Litsea*. The flowering specimens have 4-celled anthers which is the chief character in which *Litsea* differs from *Benzoin* with 2-celled anthers. The specimens agree very well with *L. sericea* Hook. f.; the only difference I find is that Hooker attributes 12 stamens to this species, but as Meissner says that the number may vary in one and the same species from 9 to 12 and as the specimens referred by Gamble to *Litsea sericea* have only 9 stamens, I do not think that this is a specific difference. The specimens show considerable variation in the pubescence of the under side of the leaves; in some specimens they are densely silky pubescent beneath (Wilson's Nos. 3678, 3671, 3681, referred by Gamble to *Lindera membranacea*) while others are glabrescent at maturity (Wilson's Nos. 3673, 3680 and 3684 referred by Gamble to *L. umbellata*). The glabrescent and pubescent forms look quite distinct and may be worthy of varietal rank, but as I have seen neither the type of *L. sericea* nor sufficient Himalayan material, I do not feel justified to propose a new variety. Where Gamble's *Lindera umbellata* var. *latifolia* belongs, I do not know, as I have not seen it. Possibly *Litsea Veitchiana* Gamble is only a variety of *L. sericea*.

From *Benzoin umbellatum* Rehder fruiting specimens of *Litsea sericea* may be distinguished by the more chartaceous leaves finely but distinctly reticulate beneath, less so above, by the glabrous or nearly glabrous winter-buds and the smaller fruits only 4-5 mm. long and borne on slenderer pedicels.

Benzoin Fabricius

Benzoin published in 1763 by Fabricius (Enum. Meth. Pl. Helmstad. ed. 2, 401) is the oldest name for the genus usually called *Lindera* Thunberg (1783, non Adanson, 1763). As Fabricius gives a good generic description and cites as synonym *Laurus* 9 of Linnaeus' *Species plantarum* which is *Laurus Benzoin*, there can be no doubt that the name given by Fabricius is valid and I fail to understand why almost all European and Japanese botanists retain *Lindera* of Thunberg as the correct name for this genus.

Benzoin aromaticum, comb. nov. — *Lindera aromatica* Brandis in Hooker's Icon. xxviii. t. 2784 (1905).

BURMA.

Benzoin cercidifolium, comb. nov. — *Lindera cercidifolia* Hemsley in Jour. Linn. Soc. xxvi. 387 (1891).

CHINA: Hupeh.

Benzoin commune, comb. nov. — *Lindera communis* Hemsley in Jour. Linn. Soc. xxvi. 387 (1891).

CHINA.

Benzoin erythrocarpum, comb. nov. — *Benzoin Thunbergii* Siebold & Zuccarini in Abh. Akad. Muench. iv. pt. iii. 204 (Fl. Jap. Fam. Nat. ii. 80) (1846), pro parte, quoad descriptionem; non *Sassafras Thunbergii* Sieb. — *Lindera umbellata* Blume, Mus. Bot. Lugd.-Bat. i. 324 (1851), pro parte, quoad descriptionem, non Thunberg. — *Lindera erythrocarpa* Makino in

Tokyo Bot. Mag., XI. (219) (1897), XIII. 138 (1899). — *Lindera Thunbergii* Makino, l. c. XIV. 184 (1900), non *Benzoin Thunbergii* Sieb. & Zucc.

JAPAN.

The reason Makino gives in Tokyo Bot. Mag. XIII. 140 for proposing a new name for this species is perfectly correct, while his transfer the following year of Siebold & Zuccarini's misapplied specific name "Thunbergii" is not correct according to our interpretation of the rules. The type of *Benzoin Thunbergii* is *Lindera umbellata* Thunberg and that name therefore becomes a synonym of *Benzoin umbellatum*.

Benzoin fragrans, comb. nov. — *Lindera fragrans* Oliver in Hooker's Icon. XVIII. t. 1788 (1888). — *Lindera* ? *Rosthornii* Diels in Bot. Jahrb. XXIX. 350 (1900).

CHINA: Hupeh.

Benzoin fruticosum, comb. nov. — *Lindera fruticosa* Hemsley in Jour. Linn. Soc. XXVI. 388 (1891).

CHINA: Hupeh.

Benzoin grandifolium, nom. nov. — *Lindera megaphylla* Hemsley in Jour. Linn. Soc. XXVI. 388 (1891).

CHINA.

Hemsley's specific name cannot be maintained, as there is the older valid combination *Benzoin megaphyllum* Kuntze.

Benzoin-pedunculatum, comb. nov. — *Lindera pedunculata* Diels in Bot. Jahrb. XXIX. 350 (1891).

CHINA: Szechuan.

Benzoin Prattii, comb. nov. — *Lindera Prattii*, Gamble in Sargent, Pl. Wilson, II. 83 (1914).

CHINA: Szechuan.

Benzoin obovatum, comb. nov. — *Lindera* ? *obovata* Franchet in Nouv. Arch. Mus. Paris, sér. 2, x. 76 (Pl. David. II. 114) (1887).

CHINA.

Benzoin Oldhamii, comb. nov. — *Lindera* ? *Oldhami* Hemsley in Jour. Linn. Soc. XXVI. 390 (1891).

FORMOSA.

Benzoin puberulum, comb. nov. — *Lindera puberula* Franchet in Nouv. Arch. Mus. Paris, sér. 2, x. 77 (Pl. David. II. 115) (1887).

CHINA.

Benzoin reflexum, comb. nov. — *Lindera reflexa* Hemsley in Jour. Linn. Soc. XXVI. 391 (1891).

CHINA: Kwangtung.

Benzoin rubronervium, comb. nov. — *Lindera rubronervia* Gamble in Sargent, Pl. Wilson, II. 82 (1914).

CHINA: Kiangsi.

Benzoin setchuenense, comb. nov. — *Lindera setchuenensis* Gamble in Sargent, Pl. Wilson, II. 82 (1914).

CHINA: Szechuan.

Benzoin strychnifolium Kuntze var. *Hemsleyanum*, comb. nov. — *Lin-*

dera strychnifolia var. ? Hemsley in Jour. Linn. Soc. xxvi. 392 (1891). — *Lindera strychnifolia* var. *Hemsleyana* Diels in Bot. Jahrb. xxix. 352 (1900).

CHINA: Hupeh, Szechuan.

Benzoin supracostatum, comb. nov. — *Lindera supracostata* H. Lecomte in Nouv. Arch. Mus. Nat. Hist. Paris, sér. 5, v. 113 (1913).

CHINA: Yunnan.

Benzoin umbellatum, comb. nov. — *Lindera umbellata* Thunberg, Fl. Jap. 145, t. 21 (1784). — *Sassafras Thunbergii* Siebold in Verh. Bat. Genoot. xii. pt. i. 23 (Syn. Pl. Oec. Jap.) (1830). — *Benzoin Thunbergii* Siebold & Zuccarini in Abh. Akad. Muench. iv. pt. iii. 204 (Fl. Jap. Fam. Nat. ii. 80) (1846), ex parte, excludenda descript. — *Lindera membranacea* Maximowicz in Bull. Acad. Sci. St. Pétersb. xii. 72 (1867); in Mél. Biol. vi. 175 (1867). — *Benzoin membranaceum* Kuntze, Rev. Gen. Pl. i. 569 (1891).

JAPAN. CHINA: Chekiang.

From China I have seen only a specimen from Ningpo, Chekiang, collected by D. Macgregor in 1908 which probably belongs here. All the other specimens referred by Hemsley and Gamble to *Lindera umbellata* as far as I have seen them, belong to *Litsea sericea* which see.

Benzoin umbellatum var. **hypoglaucum**, comb. nov. — *Lindera hypoglauca* Maximowicz in Bull. Acad. Sci. St. Pétersb. xii. 72 (1867); in Mél. Biol. vi. 274 (1867). — *Benzoin hypoleucum* Kuntze, Rev. Gen. Pl. i. 569 (1891). — *Benzoin hypoglaucum* Rehder in Bailey, Cycl. Am. Hort. i. 153. (1901). — *Lindera umbellata* var. *hypoglauca* Makino in Tokyo Bot. Mag. xiv. 185 (1900).

JAPAN.

Benzoin umbellatum var. **sericeum**, comb. nov. — *Benzoin sericeum* Siebold & Zuccarini in Abh. Akad. Muench. iv. pt. iii. 204 (Fl. Jap. Fam. Nat. i. 80) (1846). — *Lindera sericea* Blume, Mus. Bot. Lugd.-Bat. i. 324 (1851). — *Lindera umbellata* var. *sericea* Makino in Tokyo Bot. Mag. xiv. 185 (1900).

JAPAN.

Benzoin urophyllum, nom. nov. — *Lindera caudata* Diels in Bot. Jahrb. xxix. 352 (1900), non *Benzoin caudatum* (Nees) Kuntze.

CHINA: Szechuan.

(To be continued)